MANUALE STAZIONE DI SERVIZIO

633659

Vespa GTS 250 I.E. USA

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MANUALE STAZIONE DI SERVIZIO
Vespa GTS 250 I.E. USA

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N.B. Provides key information to make the procedure easier to understand and carry out.

CAUTION Refers to specific procedures to carry out for preventing damages to the vehicle.

WARNING Refers to specific procedures to carry out to prevent injuries to the repairer.

Personal safety Failure to completely observe these instructions will result in serious risk of personal injury.

Safeguarding the environment Sections marked with this symbol indicate the correct use of the vehicle to prevent damaging the environment.

Vehicle intactness The incomplete or non-observance of these regulations leads to the risk of serious damage to the vehicle and sometimes even the invalidity of the guarantee.

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ENGINE	ENG
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INDEX OF TOPICS

CHARACTERISTICS	CHAR

This section describes the general characteristics of the scooter.

Rules

This section describes general safety rules for any maintenance operations performed on the scooter.

Safety rules

- If work can only be done on the scooter with the engine running, make sure that the premises are well ventilated, using special extractors if necessary; never let the engine run in an enclosed area. Exhaust fumes are toxic.
- The battery electrolyte contains sulphuric acid. Protect your eyes, clothes and skin. Sulphuric acid is highly corrosive; in the event of contact with your eyes or skin, rinse thoroughly with water and seek immediate medical attention.
- The battery produces hydrogen, a gas that can be highly explosive. Do not smoke and avoid sparks or flames near the battery, especially when charging it.
- Fuel is highly flammable and under certain conditions can be explosive. Do not smoke in the working area, and avoid open flames or sparks.
- Clean the brake pads in a well ventilated area, directing the jet of compressed air in such a way that you do not breathe in the dust produced by the wear of the friction material. Even though the latter contains no asbestos, dust inhalation is harmful.

Maintenance rules

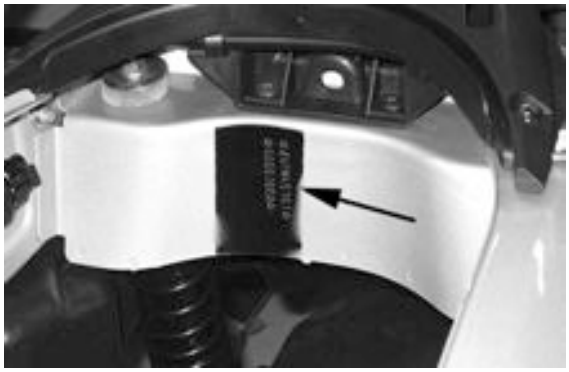
- Use original PIAGGIO spare parts and lubricants recommended by the Manufacturer. Non-original or non-conforming spares may damage the scooter.
- Use only the appropriate tools designed for this scooter.
- Always use new gaskets, sealing rings and split pins upon reassembly.
- After removal, clean the components using non-flammable or low flash-point solvent. Lubricate all the work surfaces before reassembly except the tapered couplings.
- After reassembly, make sure that all the components have been installed correctly and work properly.
- Use only equipment with metric sizes for removal, service and reassembly operations. Metric bolts, nuts and screws are not interchangeable with coupling members using English measurements. Using unsuitable coupling members and tools may damage the scooter.
- When carrying out maintenance operations on the scooter that involve the electrical system, make

sure the electrical connections have been made properly, particularly the ground and battery connections.

Vehicle identification

Chassis prefix: ZAPM45100000 ÷ 1001

Engine prefix: M451M ÷ 1001



Dimensions and mass

DIMENSIONS AND MASS

Specification	Desc./Quantity
Total loadless weight	151 ± 5 kg
Width (at the handles)	755 mm
Length	1930 mm
Wheel base	1370 mm
Saddle height	800 mm

Engine

DATA

Specification	Desc./Quantity
Type	single-cylinder, four-stroke and four liquid-cooled valves
Timing system	single overhead camshaft controlled by chain on the left-hand side, three-arm rocker set up with threaded adjuster
Bore	72 mm
Stroke	60 mm
Cubic capacity	249.29 mm
Compression ratio	10.5 ÷ 11.5
Idle speed	1650 ± 50 rpm
Air filter	sponge, impregnated with mixture (50% fuel and 50% oil)
Starting system	electric starter motor with freewheel
Lubrication	with lobe pump (inside the crankcase) controlled by chain and double filter: gauze and paper types
Fuel supply	by electronic injection with electric fuel pump
Speed max	120 Km/h
Valve clearance	Intake: 0.10 mm - Exhaust: 0.15 mm

Transmission

TRANSMISSION

Specification	Desc./Quantity
Transmission	With expanding pulley-type automatic variator with torque server, V belt, automatic clutch, gear reduction unit and transmission housing with forced air circulation cooling.

Capacities

CAPACITY

Specification	Desc./Quantity
Engine oil	approx. 1300 cc (recommended oil Selenia HI Scooter 4 Tech)
Fuel tank (including reserve ~ 2 l)	~ 9,2 l
Rear hub	250 cc (recommended oil TUTELA MATRIX)
Cooling system fluid	approx. 2.100 ÷ 2.150 l PARAFLU 11FE (Diluted)

Electrical system

ELECTRICAL COMPONENTS

Specification	Desc./Quantity
Ignition/advance	Electronic with inductive discharge and variable advance with three-dimensional mapping
Spark plug	CHAMPION RG 4 PHP
Battery	12V-12Ah
Fuses	1: 30A - 1: 15A - 3: 10A - 4: 7,5A - 1: 3A
Generator	in alternating current

Frame and suspensions

CHASSIS AND SUSPENSIONS

Specification	Desc./Quantity
Type	Structural frame in pressed sheet steel.
Front suspension	Single-arm suspension equipped with dual-effect hydraulic shock absorber with coaxial spring
Front shock absorber axial stroke	86,5 mm
Rear suspension	Engine based on oscillating fork pivoted to the chassis by 2-freedom degree arm. Pair of dual effect hydraulic shock absorbers and coaxial springs with 3-position preload adjustment
Rear shock abs. axial stroke	89,5 mm

Brakes

FRONT

Specification	Desc./Quantity
Front	Disc, 220 mm diameter and dual-piston floating

Specification	Desc./Quantity
	caliper Ø 25 mm with hydraulic control (lever on the handlebar right end)
Rear	Disc, 220 mm diameter and two opposed piston caliper Ø 30 mm with hydraulic control (lever on the handlebar left end).

Wheels and tyres

WHEELS AND TYRES

Specification	Desc./Quantity
Front light alloy rims	3,00x12
Rear light alloy rims	3,00x12
Front tyres	120/70-12" Tubeless
Rear tyres	130/70-12" Tubeless

TYRES PRESSURE

Specification	Desc./Quantity
Front tyres pressure (when cold)	1,8 bar
Rear tyres pressure (when cold)	2 bar
Tyres pressure (when cold):	2,2 bar (with passenger)

N.B.

CHECK AND ADJUST TYRE PRESSURE WITH TYRES AT AMBIENT TEMPERATURE. REGULATE PRESSURE ACCORDING TO THE WEIGHT OF THE RIDER AND ACCESSORIES.

Tightening Torques

STEERING UNIT

Name	Torque in Nm
Steering upper ring nut	35 ÷ 40
Steering lower ring nut	12 ÷ 14
Handlebar fastening screw	45 ÷ 50 (The two screws must be tightened after tightening the rear wheel axle nut at the prescribed torque.)
Handlebar control unit U-bolts fixing screws	7 ÷ 10

CHASSIS UNIT

Name	Torque in Nm
Oscillating arm pin - engine	64 ÷ 72
Oscillating arm pin - body	76 ÷ 83

Name	Torque in Nm
Engine and vehicle side oscillating arm junction pin	33 ÷ 41
Silent-block support plate bolt	42 ÷ 52
Centre-stand bolt	32 ÷ 40
Side stand fixing bolt	35 ÷ 40

FRONT SUSPENSION

Name	Torque in Nm
Screw fixing the shock absorber to the shock absorber plate - brake pliers	20 ÷ 27
Wheel axle nut	74 ÷ 88
Wheel screw	20 ÷ 25
Screw fixing the front mudguard to the steering wheel	5 ÷ 6,5
Shock absorber bottom fixing	20 - 30 Nm

FRONT BRAKE

Name	Torque in Nm
Pipe - pump oil union	20 ÷ 25
Brake fluid fitting - calliper	19 ÷ 24
Screw fixing the pliers to the shock absorber plate - brake pliers	24 ÷ 27
Disc tightening screw	6 (Apply thread-holding LOCTITE medium type 242.)
Oil drainage screw	12 ÷ 16
Pads fixing pin	19,6 ÷ 24,5
Brake pump tank screws	1.5 ÷ 2

REAR SUSPENSION

Name	Torque in Nm
Screw fixing the left shock absorber support plate to the crankcase	20 ÷ 25
Shock absorber top fixing	20 ÷ 25
Shock absorber bottom fixing	33 ÷ 41
Rear gear shaft	104 - 126
Screws fixing the wheel to the hub	20 ÷ 25
Silencer - shock absorber support arm screws on engine	20 ÷ 25 (The two screws must be tightened after tightening the rear wheel axle nut at the prescribed torque.)

REAR BRAKE

Name	Torque in Nm
Pipe - pump oil union	20 ÷ 25
Brake fluid tube- calliper	20 ÷ 25
Rear disc tightening bolt	11 ÷ 13
Oil drainage screw	12 ÷ 16
Screw fixing the brake caliper to the engine	20 ÷ 25
Brake pump tank screws	1.5 ÷ 2
Calliper coupling screw	30 ÷ 33 Nm

MUFFLER

Name	Torque in Nm
Muffler heat guard clamping screw	4 ÷ 5
Screw for fixing muffler to the support arm	20 ÷ 25
Lambda probe tightening on manifold	40 ÷ 50
Manifold-muffler joint tightening	12 ÷ 13

LUBRICATION

Name	Torque in Nm
Hub oil drainage tap	15 ÷ 17
Oil filter on the crankcase fitting	27 ÷ 33
Engine oil drainage tap/gauze filter	24 ÷ 30
Oil filter	4 ÷ 6
Oil pump cover screws	7 ÷ 9
Screws fixing oil pump to the crankcase	5 ÷ 6
Oil pump command crown screw	10 ÷ 14
Oil pump cover plate screws	4 ÷ 6
Oil sump screws	10 ÷ 14
Minimum oil pressure sensor	12 - 14

CYLINDER HEAD

Name	Torque in Nm
Spark plug	12 - 14
Head cover screws	6 ÷ 7
Nuts for head fastening to the cylinder	7±1 + 10±1 + 270°
Head fixing side screws	11 ÷ 12 Nm
Starter ground screw	7 ÷ 8.5
Tappet adjustment check nut	6 ÷ 8

Name	Torque in Nm
Inlet manifold screws	11 ÷ 13
Timing chain tensioner pad screw	10 ÷ 14
Start up counterweight support screw	11 ÷ 15
Timing chain tensioner support screw	11 ÷ 13
Timing chain tensioner central screw	5 ÷ 6
Camshaft retention plate screw	4 ÷ 6

TRANSMISSION

Name	Torque in Nm
Belt support roller screw	11 ÷ 13
Clutch assembly nut on driven pulley	45 ÷ 50
Drive pulley nut	75 ÷ 83
Transmission cover screws	11 ÷ 13
Driven pulley shaft nut	54 ÷ 60
Rear hub cap screws	24 ÷ 27

FLYWHEEL

Name	Torque in Nm
Flywheel cover screw	11 ÷ 13
Stator assembly screws	3 - 4 (Apply LOCTITE medium type 242 thread-lock)
Flywheel nut	94 - 102 N.m
Pickup clamping screws	3 ÷ 4
freewheel mounting screws on the flywheel	13 - 15

CRANKCASE AND CRANKSHAFT

Name	Torque in Nm
Internal engine crankcase bulkhead (transmission-side half shaft) screws	4 ÷ 6
Engine-crankcase coupling screws	11 ÷ 13
Starter screws	11 ÷ 13
Crankcase timing cover screws	3.5 - 4.5 (Apply LOCTITE medium type 242 threadlock)

COOLING

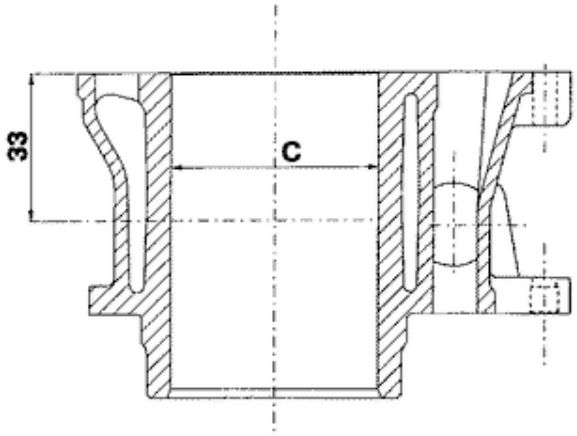
Name	Torque in Nm
Water pump rotor cover	3 ÷ 4
Thermostat cover screws	3 ÷ 4

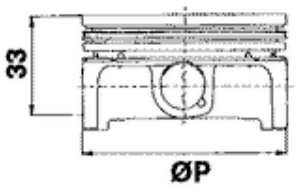
Name	Torque in Nm
Bleed screw:	3

Overhaul data

Assembly clearances

Cylinder - piston assy.





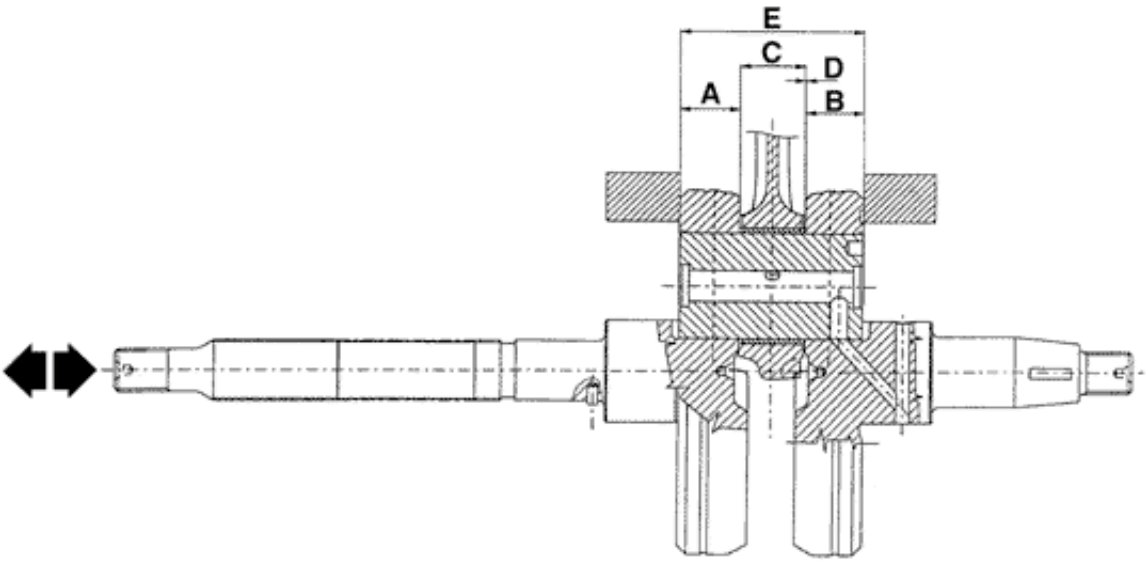
ENGINE COUPLING CATEGORY

Name	Play	Initials	Cylinder	Piston	Play on fitting
Cylinder		M	72.01 ÷ 72.017	71.953 ÷ 71.960	0.050 - 0.064
Cylinder		N	72.017 - 72.024	71.960 ÷ 71.967	0.050 - 0.064
Piston		P	72.031 - 72.038	71.974 ÷ 71.981	0.050 - 0.064
Piston		O	72.024 - 72.031	71.967 ÷ 71.974	0.050 - 0.064

Crankcase - crankshaft - connecting rod

CRANKSHAFT

Axial clearance between crankshaft and connecting rod



AXIAL CLEARANCE BETWEEN CRANKSHAFT/CRANKCASE

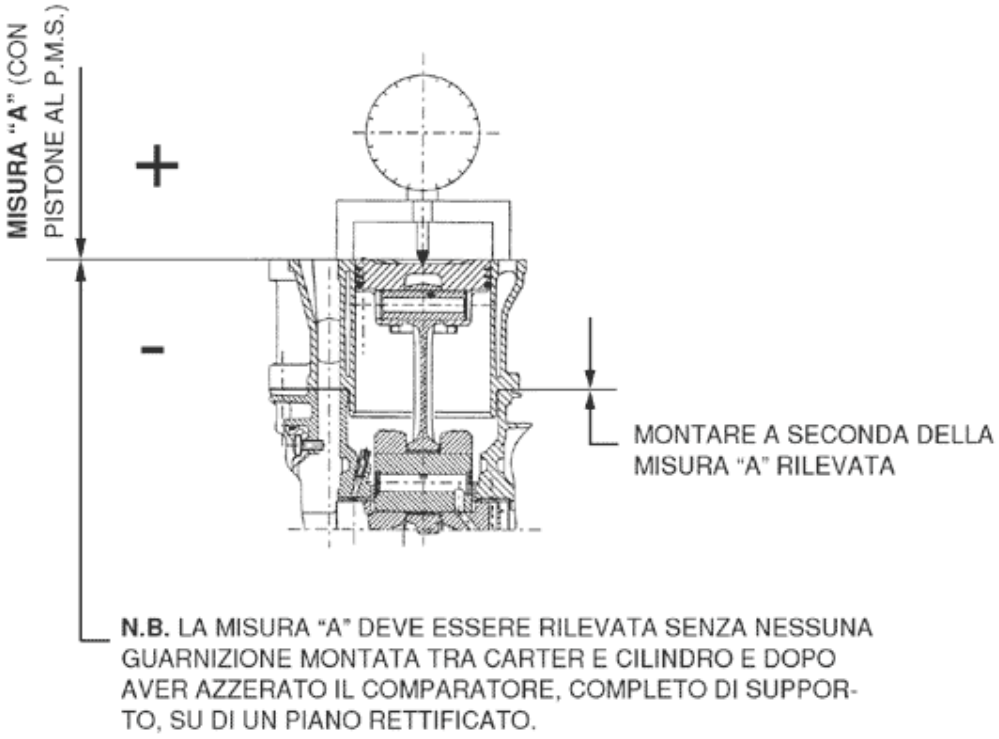
Name	Description	Dimensions	Initials	Quantity
Transmission side half shaft		16.6 +0-0.05	A	D = 0.20 - 0.50
Flywheel side half shaft		16.6 +0-0.05	B	D = 0.20 - 0.50
Connecting rod		18 -0.10 -0.15	C	D = 0.20 - 0.50
Spacer tool		51.4 +0.05	E	D = 0.20 - 0.50

Slot packing system

Characteristic

Compression ratio

10.5 - 11.5 : 1


MISURA "A" (CON PISTONE AL P.M.S.)
+
-
MONTARE A SECONDA DELLA MISURA "A" RILEVATA
N.B. LA MISURA "A" DEVE ESSERE RILEVATA SENZA NESSUNA GUARNIZIONE MONTATA TRA CARTER E CILINDRO E DOPO AVER AZZERATO IL COMPARATORE, COMPLETO DI SUPPORTO, SU DI UN PIANO RETTIFICATO.

Measurement "**A**" to be taken is a value of piston re-entry, it indicates by how much the plane formed by the piston crown falls below the plane formed by the top of the cylinder. The further the piston falls inside the cylinder, the less the base gasket to be applied (to recover the compression ratio) and viceversa.

N.B.

MEASUREMENT "A" MUST BE TAKEN WITHOUT ANY GASKET FITTED BETWEEN THE CRANKCASE AND CYLINDER AND AFTER RESETTING THE GAUGE, EQUIPPED WITH A SUPPORT, ON A GROUND PLAIN

ENGINE 250 SHIMMING

Name	Measure A	Thickness
Shimming	3.70 - 3.60	0.4 ± 0.05
Shimming	3.60 - 3.40	0.6 ± 0.05
Shimming	3.40 - 3.30	0.8 ± 0.05

Products

TABLE OF RECOMMENDED PRODUCTS

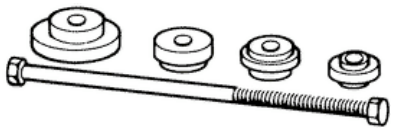
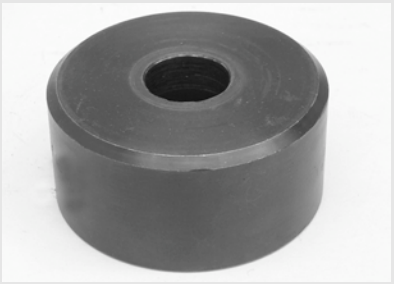
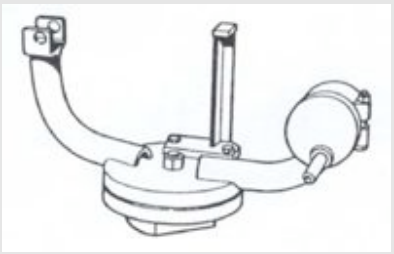
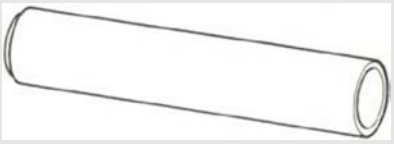
Product	Description	Specifications
TUTELA MATRYX MOTO RIDER	Rear hub oil	SAE 75W/85 API GL4 synthetic multigrade oil
SELENIA HI Scooter 4 Tech	Lubricating oil for flexible transmission (gas control)	Oil for 4-stroke engines

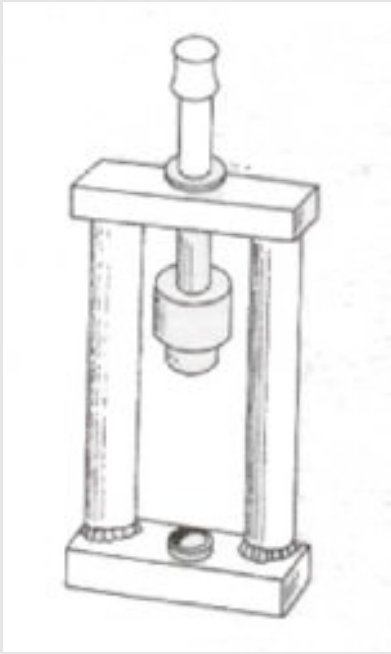
Product	Description	Specifications
SELENIA Air Filter Oil	Oil for air filter cleaning	Mineral oil with specific additive for increased adhesiveness ISO VG 150
TUTELA TP1	Grease the brake lever and throttle grip	NLGI 1-2 complex calcium soap base white grease spray
SELENIA HI Scooter 4 Tech	Engine oil	Synthetic oil SAE 5W/40 that meets the API SG specifications.
TUTELA TOP 4	Brake fluid	SAE J1703, NHTSA 116 DOT 4, ISO 4925 synthetic fluid
PARAFLU MOTO RIDER (Ready to use)	coolant	Mono-ethylene glycol based antifreeze, CUNA NC 956-16 fluid

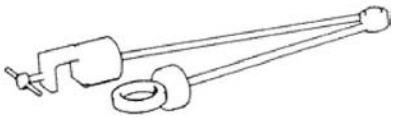
INDEX OF TOPICS

TOOLING	TOOL

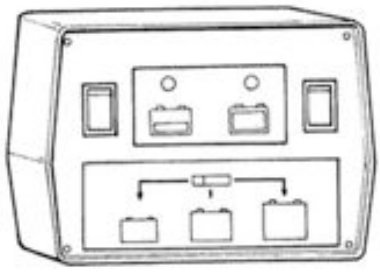
SPECIFIC TOOLS

Stores code	Description	
001330Y	Tool for fitting steering seats	
001467Y017	Bell for bearings outer diam. 39 mm	
001467Y014	Puller for removing 15 mm bearings	
002095Y	Engine support	
002465Y	Pliers for snap rings	
006029Y	Punch for fitting the seat of the fifth wheel on the steering column	

Stores code	Description	
020004Y	Puller for removing the fifth wheel from the headstock	
020021y	Front suspension overhaul kit	
020036y	Drift	
020038y	Drift	
020055Y	Key for steering column ring-nut	

Stores code	Description	
020074Y	Support base for alignment control of crankshaft	
020150Y	Air heater support	
020151Y	Air heater	
020193Y	Oil pressure gauge	
020262Y	Crankcase splitting strip	
020263Y	Driven pulley assembly sheath	

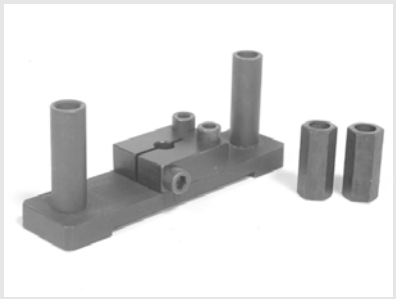
Stores code	Description	
020306Y	Punch for fitting valve sealing ring	
020329Y	MITYVAC vacuum pump	
020330Y	Stroboscopic light for timing control	
020331Y	Digital multimeter	
020332Y	Digital rev counter	

Stores code	Description	
020333Y	Single battery charger	
020334Y	Multiple battery charger	
020335Y	Magnetic support for gauge	
020357Y	32 x 35 mm adaptor	
020359Y	42 x 47 mm adaptor	
020360Y	52 x 55 mm adaptor	
020363Y	20mm guide	

Stores code	Description	
020364Y	25 mm guide	
020365y	22 mm guide	
020375Y	Adapter 28 x 30 mm	
020376Y	Handle for adaptors	
020382Y	Tool for removing valve cotters equipped with part 012	
020382Y011	adapter for valve removal tool	

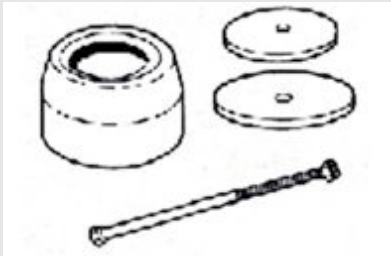
Stores code	Description	
020393Y	Piston assembly band	
020412Y	15 mm guide	
020423Y	driven pulley stop wrench	
020424Y	Punch for fitting driven pulley roller casing	
020426Y	Piston fitting fork	

Stores code	Description	
020431Y	Valve oil seal extractor	
020434Y	Oil pressure gauge connection	
020441y	26 x 28 mm adapter	
020444Y	Driven half pulley spring compressor fit/removal tool	
020456Y	Diameter 24 mm adaptor	
020477Y	Adapter 37 mm	

Stores code	Description	
020483Y	30 mm guide	
020489Y	Hub cover support stud bolt set	
494929Y	Exhaust gas analyser	
020428Y	Piston position check support	
020460Y	Scooter diagnostics tester	

Stores code	Description	
020621Y	H.V. cable extraction adapter	
020481Y	Control unit interface wiring	
001467Y035	Bell for bearing outside diameter 47 mm	
020626Y	Drive pulley stop wrench	
001467Y013	Extraction pliers for 15 mm diameter bearings	

Stores code	Description	
020627Y	Flywheel stop wrench	
020467Y	Flywheel extractor	
020454Y	Tool for fitting piston pin stops (200 - 250)	
020622Y	Transmission-side oil guard punch	
020480Y	Fuel pressure check kit	

Stores code	Description	
020244Y	15 mm diameter punch	
020115Y	Diameter 18 punch	
020271Y	Tool for removing-fitting silent bloc	
020638Y	250 I. E. ENGINE - ABS SOFT-WARE	
020469Y	Reprogramming kit for scooter diagnostic tester	

INDEX OF TOPICS

MAINTENANCE	MAIN

Maintenance chart

EVERY 2 YEARS

60'

Action
coolant - change
Brake fluid - change

AFTER 1,000 KM

60'

Action
Safety locks - check
Throttle lever - adjustment
Engine oil filter - replacement
Electrical system and battery - check
Coolant level - check
Brake oil level - check
Engine oil - change
Brake pads - condition and wear check
Tyre pressure and wear - check up
Vehicle and brake test - road test
Hub oil - change
Steering - check up

AFTER 5,000 KM 25,000 KM 35,000 KM 55,000 KM 65,000 KM

10'

Action
Engine Oil - level check/top up
Brake pads - condition and wear check

AT 10,000 KM AT 50,000 KM, AT 70,000 KM

100'

Action
Safety locks - check
Throttle lever - adjustment
Air filter - cleaning
Air filter belt compartment - check
Engine oil filter - replacement

Action
Electrical system and battery - check
Coolant level - check
Brake oil level - check
Engine oil - change
Brake pads - condition and wear check
Sliding block / variable speed rollers - change
Tyre pressure and wear - check up
Vehicle and brake test - road test
Hub oil - check
Suspensions - check
Steering - check up

AT 15.000 KM 45.000 KM 75.000 KM

Action
Engine Oil - level check/top up
Brake pads - condition and wear check
Transmission driving belt - replacement

AT 20.000 KM , 40.000 KM , 80.000 KM

Action
Spark plug - Replacement
Throttle lever - adjustment
Air filter - cleaning
Air filter belt compartment - check
Engine oil filter - replacement
Valve clearance - check
Electrical system and battery - check
Coolant level - check
Brake oil level - check
Engine oil - change
Brake pads - condition and wear check
Sliding block / variable speed rollers - change
Tyre pressure and wear - check up
Vehicle and brake test - road test
Hub oil - change
Suspensions - check

Action
Steering - check up

30.000 KM

Action
Safety locks - check
Transmission driving belt - replacement
Throttle lever - adjustment
Air filter - cleaning
Air filter belt compartment - check
Engine oil filter - replacement
Electrical system and battery - check
Coolant level - check
Brake oil level - check
Engine oil - change
Brake pads - condition and wear check
Sliding block / variable speed rollers - change
Tyre pressure and wear - check up
Vehicle and brake test - road test
Hub oil - check
Suspensions - check
Steering - check up

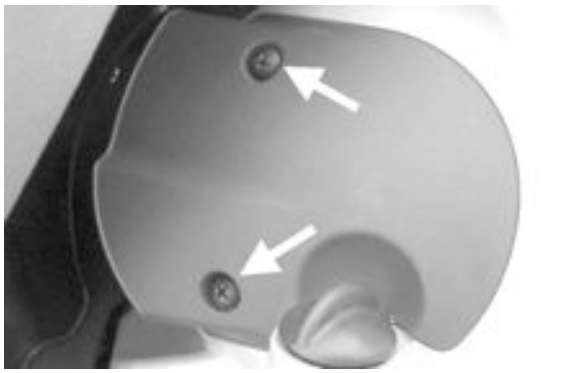
60,000 KM

190'

Action
Spark plug - Replacement
Transmission driving belt - replacement
Throttle lever - adjustment
Air filter - cleaning
Air filter belt compartment - check
Engine oil filter - replacement
Valve clearance - check
Electrical system and battery - check
Coolant level - check
Brake oil level - check
Engine oil - change

Action
Brake pads - condition and wear check
Sliding block / variable speed rollers - change
Tyre pressure and wear - check up
Vehicle and brake test - road test
Hub oil - change
Suspensions - check
Steering - check up

Checking the spark advance



The ignition advance is determined electronically on the basis of parameters known by the control unit. For this reason it is impossible to state reference values based on the number of engine revs. The ignition advance value can be measured at any time by means of the diagnostic tester. It is possible to check whether the ignition advance determined by the system does in fact correspond with the value actually activated on the engine, by means of the stroboscopic light.

Proceed as follows:

- Remove the spark plug.
- Remove the plastic cover on the flywheel cover shown in the photograph.
- Remove the transmission compartment air intake cover shown in the photograph.
- Turn the drive pulley fan using a screwdriver until the reference marks between the flywheel and flywheel cover meet as shown in the photograph.
- Bring the reference mark onto the transmission side between the fan and the transmission cover as shown in the photograph.
- Refit the spark plug .
- Refit the plastic cap on the flywheel cover.
- Adjust the spark gap to the contact position (no

reference mark visible) and install it on engine between the spark plug and spark plug hood

- Connect the induction calliper on the spark gap cable respecting the proper polarity (the arrow on the calliper must be pointing at the spark plug).
- Connect the diagnostic tester.
- Start the engine.
- Select the menu on the "parameter" function.
- Select the stroboscopic light command in the traditional four-stroke engine position (1 spark 2 revs).
- Check that the actual and declared rpm and ignition advance values correspond, using the diagnostic tester .

If the values do not correspond, check:

- distribution timing
- revolution-timing sensor
- injection control unit

Specific tooling

020460Y Scooter diagnostics tester

020330Y Stroboscopic light for timing control

020621Y H.V. cable extraction adapter

Spark plug

-Position the vehicle on its stand

-Open the saddle and extract the helmet compartment;

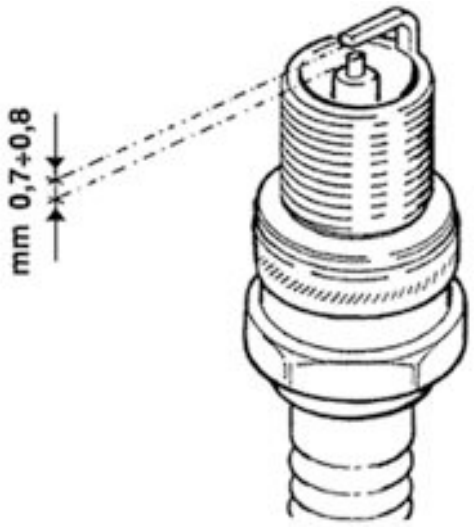
-Disconnect the cover from the plug lead;

-Unscrew the spark plug using the supplied spark plug spanner;

-Check the conditions of the spark plug, make sure the insulation is intact, that the electrodes are not excessively worn or dirty, conditions of the

sealing washer and measure the gap between the electrodes with a feeler.

- Adjust the gap if necessary, carefully bending the side electrode. In the event of irregularities (as described above) replace the spark plug with the prescribed type;
- Position the spark plug at the correct angle and manually tighten it all the way down, then use the specific spanner to tighten it;
- Put the cap back on the sparkplug tightly, and continue with the reassembly operations.



CAUTION

THE SPARK PLUG CAN ONLY REMOVED WHEN THE ENGINE IS COOL. IT MUST BE REPLACED EVERY 20,000 KM. THE USE OF ELECTRONIC IGNITIONS AND SPARK PLUGS OTHER THAN THE PRESCRIBED TYPES CAN RESULT IN SERIOUS DAMAGE TO THE ENGINE.

Characteristic

Electrode gap

0.7 to 0.8 mm

Electric characteristic

Spark plug

CHAMPION RG4 PHP

Locking torques (N*m)

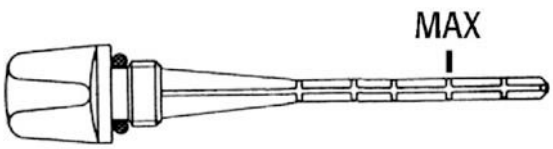
Spark plug 12 - 14

Hub oil

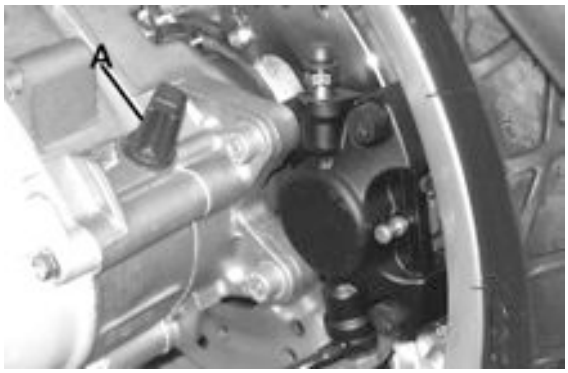
Check

-Stand the scooter on the centre-stand on flat ground;

-Remove the oil dipstick "**A**", dry it with a clean cloth and put it back into its hole **tightening it completely**;

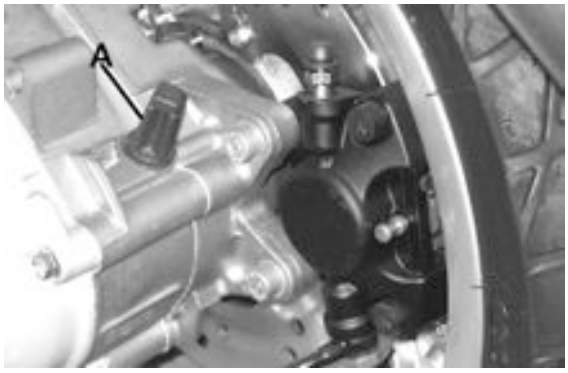


Remove the rod and check that the oil level is slightly over the second notch starting from the lower end; if the level is under the MAX. mark, it needs to be filled with the right amount of hub oil.
-Screw up the oil dipstick again and make sure it is locked properly into place.



Replacement

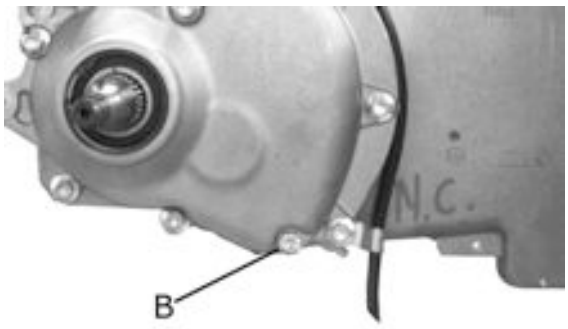
- Remove the oil cap "**A**".
- Unscrew the oil drainage tap "**B**" and drain out all the oil.
- Screw in the drain plug again and fill the hub with the prescribed oil.



Recommended products

TUTELA MATRYX MOTO RIDER Rear hub oil

SAE 75W/85 API GL4 synthetic multigrade oil



Characteristic

Rear hub oil

Capacity: approx. 250 cc

Locking torques (N*m)

Hub oil drainage screw 15 - 17 Nm

Air filter

Proceed as follows:

1. unscrew set screw «**A**».

2. unscrew nut «**B**» located under the body panel.

3. remove the left side panel;

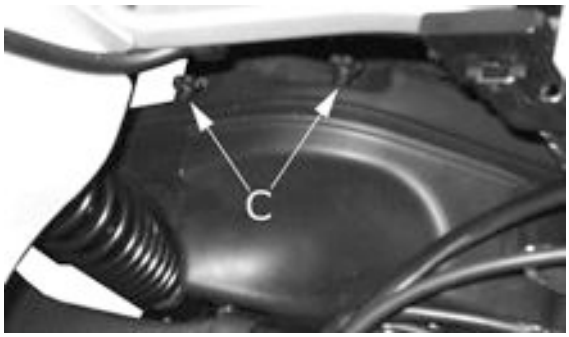
4. remove the helmet compartment;

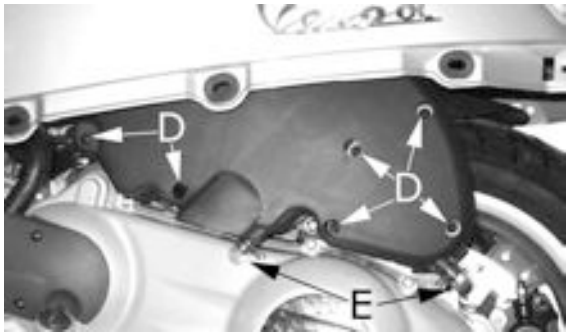
5. unscrew set screws «**C**» which are accessible when the helmet compartment has been re-

moved;

6. unscrew screws «**D**» and remove the air filter cover.

Extract the filter element and wash it with water and car wash soap, then dry it with a clean rag and light blasts of compressed air and put it in a mixture of recommended oil and gas with a 50% mixture. Then gently squeeze the filter element, let it drip and refit it. Any deposits of oil or water in the filter box can be eliminated by removing the two rubber caps «**E**».





IF THE VEHICLE IS USED ON DUSTY ROADS IT IS NECESSARY TO CARRY OUT MAINTENANCE CONTROLS OF THE AIR FILTER TO AVOID DAMAGING THE ENGINE.

Recommended products

SELENIA Air Filter Oil Oil for air filter cleaning

Mineral oil with specific additive for increased adhesiveness ISO VG 150

Engine oil

Engine oil is used in 4-stroke engines in order to lubricate the timing gears, the bench supports and the thermal group. **An insufficient quantity of oil can cause serious damage to the engine itself.** In all 4-stroke engines, the deterioration in the oil characteristics, as well as a certain level of consumption, should be considered normal, especially during running in. Consumption can particularly reflect the conditions of use (e.g.: when driving at full acceleration all the time, oil consumption increases).

Replacement

At 1,000 km and after every 10,000 km, the oil and the filter must be changed. The engine must be drained by running off the oil from drainage tap

"**B**" of the flywheel side gauze pre-filter; furthermore to assist the drainage of the oil, you should loosen cap/dipstick "**A**". Once all the oil has drained from the drainage hole, undo oil filter "**C**" and remove it.

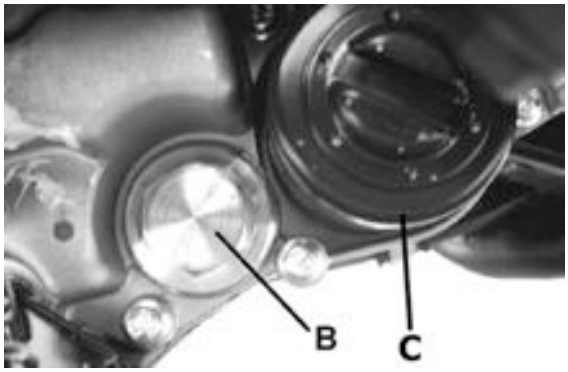
Make sure the pre-filter and discharge tap O-rings are in good condition.

Lubricate them and refit the gauze filter and oil drainage tap, screwing them up to the prescribed torque.

Refit the new cartridge filter being careful to lubricate the O-ring before fitting it.

Change the engine oil.

Since a certain quantity of oil still remains in the circuit, filling must be done with oil from cap "**A**". Then start the scooter, allow it to run for a few minutes and then switch off again. after five minutes check the level and if necessary top up without exceeding the **MAX** level. The cartridge filter must be replaced every time the oil is changed. Use new oil of the recommended type for topping up and changing purposes.



N.B.

THE ENGINE MUST BE HOT WHEN THE OIL IS CHANGED.

Recommended products

SELENIA HI Scooter 4 Tech Engine oil

Synthetic oil SAE 5W-40 that exceeds the API SJ specifications.

Check

This operation must be carried out with the engine cold and following the procedure below:

Place the scooter on its centre stand and on flat ground. Undo cap/dipstick "**A**", dry it off with a clean cloth and replace it, **screwing down completely**. Remove the cap/dipstick and check that the level is between the min and max. marks; top up if necessary.

The MAX. level mark indicates a quantity of around 1300 cc of engine oil. If the check is carried out after the scooter has been used, and therefore with a hot engine, the level will be lower; in order to carry out a correct check it is necessary to wait at least 10 minutes after the engine has been stopped, so as to get the correct level.

Oil top up

Any top ups must be one after the level has been checked and in all cases adding oil **without ever exceeding the MAX. level** .

Restoration of the level from **MIN** to **MAX** requires approximately **200 cc**.

Engine oil filter

The cartridge filter must be replaced every time the oil is changed. Use new oil of the recommended type for topping up and changing purposes.

Make sure the pre-filter and discharge tap O-rings are in good condition. Lubricate them and refit the gauze filter and oil drainage tap, screwing them up to the prescribed torque. Refit the new cartridge filter being careful to lubricate the O-ring before the fitting. Change the engine oil.

Recommended products

SELENIA HI Scooter 4 Tech Engine oil

Synthetic oil SAE 5W-40 that exceeds the API SJ specifications.

Oil pressure warning light

The scooter is equipped with a signal light on the dashboard that lights up when the key is turned to the "**ON**" position. This light should go out, however, once the engine has started.

If the light comes on during braking, at idling speed or while turning a corner, it is necessary to check the oil level and top up if required.

Checking the ignition timing

-Remove the plastic cap on the flywheel cover

-Turn the flywheel until the reference mark "T" on the rotor corresponds with the reference mark on the flywheel cover as shown in the figure (TDC).

Make sure that the 4V reference point on the camshaft command pulley is aligned with the reference point on the head as shown in the second figure. If the reference is opposite the indicator on the head, turn the crankshaft once more.
For the use of this reference mark, remove the spark plug and turn the engine in the direction that is the reverse of the normal direction using a calliper spanner applied to the camshaft command pulley casing.

Cooling system

Introduction of the engine coolant.
The fluid level must checked every 10,000 kilometres with a cold engine, in the way shown below:
Place the vehicle on its centre stand and on flat ground.
- Undo the screw shown in the figure and remove the expansion tank cap on RHS.
- Top up if the fluid level is near or below the MIN level edge. The liquid level must always be between the MIN and MAX level.
-The coolant consists of an ethylene glycol and corrosion inhibitor based 50% demineralised water- antifreeze solution mix.

CAUTION

TO PREVENT THE COOLANT FROM LEAKING OUT OF THE EXPANSION TANK DURING USE, BE SURE TO NEVER EXCEED THE MAX. LEVEL WHEN RE-

FILLING

Braking system

Level check

The front and rear brake fluid tanks are located on the pumps on the handlebar cover. Proceed as follows:

- Remove the brake pump cover.
- Rest the vehicle on the central stand with the handlebars in a central position;
- Check the fluid level through the hole shown in the figure. The level will go down to a certain extent due to lining wear.

Top-up

- Rest the vehicle on a flat ground and on the central stand.
- Remove the brake pump cover as shown in the figure.

- Check the brake fluid level by the special indicator located on the pump, as shown in the figure
- If the level is below minimum, fill by the screws shown in the figures

- Remove the gasket and fill with fluid DOT 4 to fully cover the indicator

- For re-assembly, perform the operations for removal in the reverse order according to the tightening torques of the tank cover screws.

CAUTION

KEEP THE BRAKE FLUID AWAY FROM THE SKIN, THE EYES AND CLOTHING. IN CASE OF CONTACT, RINSE GENEROUSLY WITH WATER.

BRAKE FLUID IS HIGHLY CORROSIVE; IT IS THEREFORE VERY IMPORTANT TO AVOID CONTACT WITH PAINTED PARTS DURING TOP-UP PROCEDURES. THE BRAKING CIRCUIT FLUID IS HYGROSCOPIC, IN OTHER WORDS, IT ABSORBS HUMIDITY FROM THE SURROUNDING AIR. IF THE CONTENT OF MOISTURE IN THE BRAKING FLUID EXCEEDS A CERTAIN VALUE, IT WILL LEAD TO INEFFICIENT BRAKING.

CAUTION

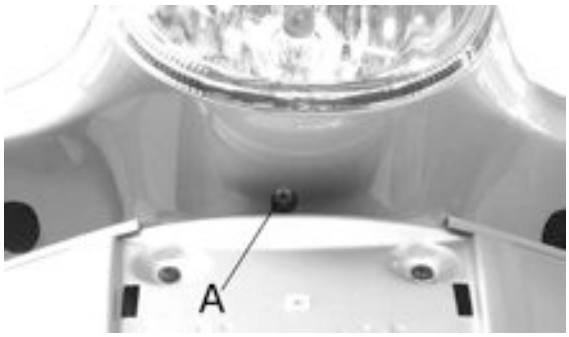
NEVER USE BRAKING FLUID FROM CONTAINERS THAT HAVE ALREADY BEEN OPENED, OR PARTIALLY USED. IN NORMAL WEATHER CONDITIONS, THE FLUID SHOULD BE REPLACED EVERY 20,000 KM OR IN ANY CASE EVERY 2 YEARS.

Locking torques (N*m)

Brake pump basin screws 15 ÷ 20

Headlight adjustment

Proceed as follows:



1. Place the vehicle, in riding condition, with the tyres correctly inflated, on a flat piece of ground at a distance of 10 m from a white screen situated in a shaded area, making sure that the scooter is perpendicular to the screen;

2. Turn on the headlight and check that the edge of the beam projected on the screen is not more than 9/10 of the height of the centre of the headlight from the ground, and not less than 7/10;

3. If otherwise, adjust the right headlight with screw «**A**».

WARNING

THE ABOVE PROCEDURE COMPLIES WITH THE EUROPEAN STANDARDS REGARDING MAXIMUM AND MINIMUM HEIGHT OF LIGHT BEAMS. REFER TO THE STATUTORY REGULATIONS IN FORCE IN EVERY COUNTRY WHERE THE SCOOTER IS USED.

INDEX OF TOPICS

TROUBLESHOOTING	TROUBL

This section makes it possible to find the solutions to use in troubleshooting.

For each breakdown, a list of the possible causes and respective interventions is given.

Engine

Excessive oil consumption/Exhaust smoke

EXCESSIVE CONSUMPTION

Possible Cause	Operation
Wrong valve adjustment	Adjust the valve clearance properly
Overheated valves	Remove the head and the valves, grind or replace the valves
Misshapen/worn valve seats	Replace the head assembly
Worn cylinder, Worn or broken piston rings	Replace the piston cylinder assembly or piston rings
Worn or broken piston rings or piston rings that have not been fitted properly	Replace the piston cylinder assembly or just the piston rings
Oil leaks from the couplings or from the gaskets	Check and replace the gaskets or restore the coupling seal
Worn valve oil guard	Replace the valve oil guard
Worn valve guides	Check and replace the head assembly if required

Insufficient lubrication pressure

POOR LUBRICATION PRESSURE

Possible Cause	Operation
By-Pass remains open	Check the By-Pass and replace if required. Carefully clean the By-Pass area.
Oil pump with excessive clearance	Perform the dimensional checks on the oil pump components
Oil filter too dirty	Replace the cartridge filter
Oil level too low	Restore the level using the recommended oil type (Selenia HI Scooter 4 Tech)

Transmission and brakes

Clutch grabbing or performing inadequately

IRREGULAR CLUTCH PERFORMANCE OR SLIPPAGE

Possible Cause	Operation
Faulty clutch	Check that there is no grease on the masses. Check that the clutch mass contact surface with the casing is mainly in the centre with equivalent characteristics on the three masses. Check that the clutch casing is not scored or worn in an anomalous way

Insufficient braking

INEFFICIENT BRAKING SYSTEM

Possible Cause	Operation
Inefficient braking system	Check the pad wear (1.5 min). Check that the brake discs are not worn, scored or warped. Check the correct level of fluid in the pumps and replace brake fluid if necessary. Check there is no air in the circuits; if necessary, bleed the air. Check that the front brake calliper moves in axis with the disc.
Fluid leakage in hydraulic braking system	Elastic fittings, piston seals or brake pump breakdown, replace
Brake disc slack or distorted	Check the brake disc screws are locked; measure the axial shift of the disc with a dial gauge and with wheel mounted on the scooter.

Brakes overheating

BRAKE OVERHEATING

Possible Cause	Operation
Defective sliding of pistons	Check calliper and replace any damaged part.
Brake disc slack or distorted	Check the brake disc screws are locked; use a dial gauge and a wheel mounted on the scooter to measure the axial shift of the disc.
Clogged compensation holes on the pump	Clean carefully and blast with compressed air
Reinflated or glued rubber gaskets	Replace gaskets.

Steering and suspensions

Heavy steering

STEERING HARDENING

Possible Cause	Operation
Steering hardening	Check the torque of the upper and lower ring nut.

Possible Cause	Operation
	If irregularities continue in turning the steering even after making the above adjustments, check the seats in which the ball bearings rotate: if they are recessed or if the balls are squashed, replace them.

Excessive steering play

EXCESSIVE STEERING BACKLASH

Possible Cause	Operation
Torque not conforming	Check the torque of the upper and lower ring nut. If irregularities continue in turning the steering even after making the above adjustments, check the seats in which the ball bearings rotate: if they are recessed or if the balls are squashed, replace them.

Noisy suspension

NOISY SUSPENSION

Possible Cause	Operation
Malfunctions in the suspension system	If the front suspension is noisy, check: the efficiency of the front shock absorbers; the condition of the ball bearings and relevant lock-nuts, the limit switch rubber buffers and the movement bushings. In conclusion, check the tightening torque of the wheel hub, the brake calliper, the shock absorber disk in the attachment to the hub and the steering tube.

Suspension oil leakage

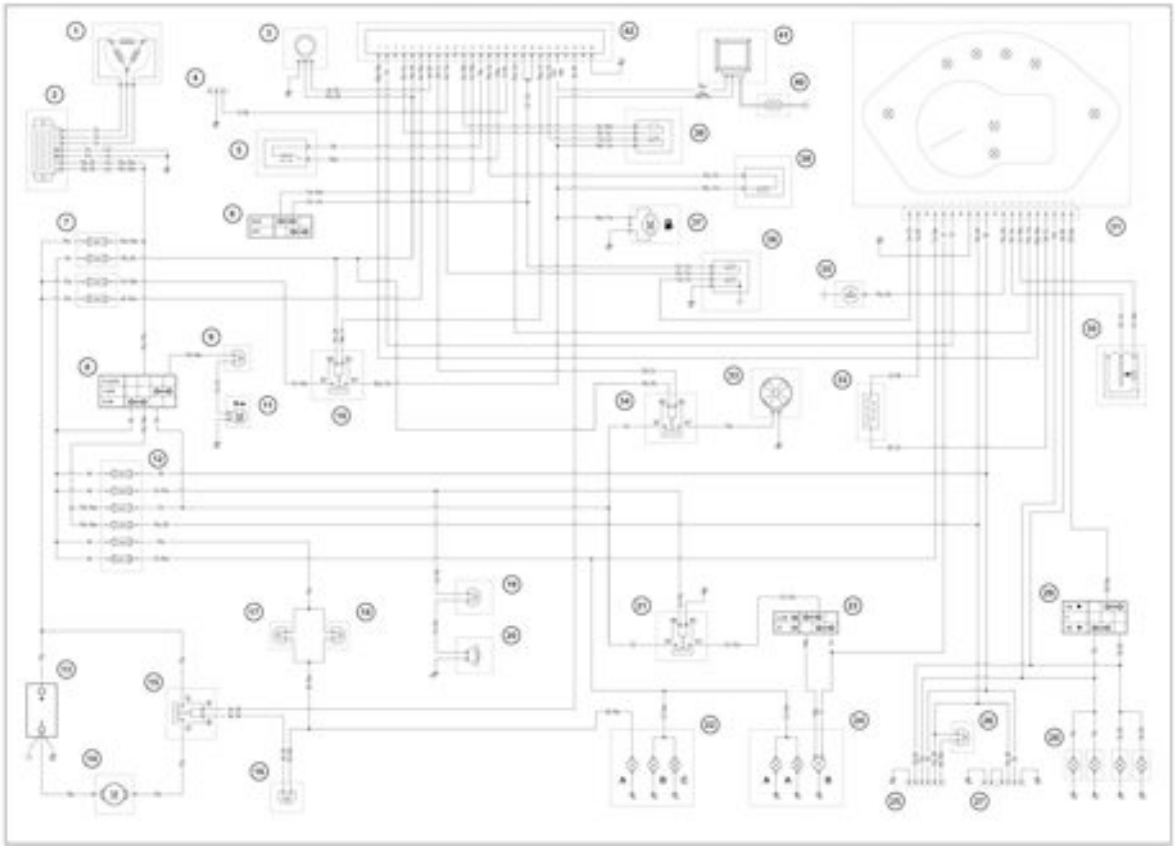
OIL LEAKAGE FROM SUSPENSION

Possible Cause	Operation
Seal fault or breakage	Replace the shock absorber Check the condition of wear of the steering covers and the adjustments.

INDEX OF TOPICS

ELECTRICAL SYSTEM	ELE SYS

Schema valido dal numero di telaio ZAPM4510000001579 in poi.



ELECTRICAL SYSTEM

	Specification	Desc./Quantity
1	Flywheel magneto	
2	Voltage regulator	
3	Immobiliser antenna	
4	Diagnostic inlet	
5	Engine rpm sensor	
6	Engine stop switch	
7	N° 2 fuse boxes in under helmet compartment	
8	Ignition key-switch	
9	Saddle opening button	
10	Injection load remote control	
11	Saddle opening actuator	
12	Glove compartment fuse box	
13	Battery	12 V - 12 Ah
14	Starter motor	

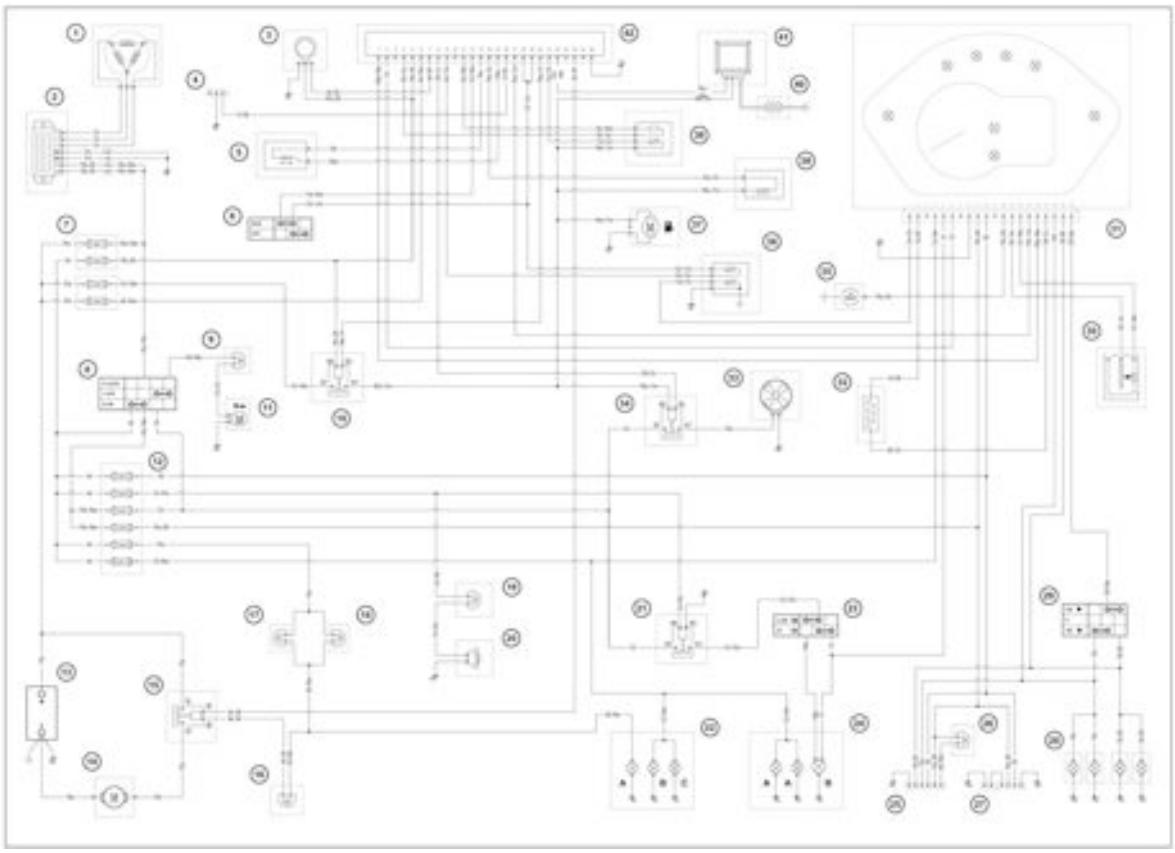
	Specification	Desc./Quantity
15	Starter remote control	
16	Starter button	
17	Rear stop light switch	
18	Stop switch on front brake	
19	Horn button	
20	Horn	
21	Headlight remote control switch	
22	Rear Headlights	**A** Stop light **B** Parking light **C** License plate light
23	Light switch	
24	Front Headlights	**A** Parking light **B** High beam/low beam
25	Anti-theft alarm fitting	
26	helmet compartment button prewiring	
27	Intercom fitting	
28	Turn indicator bulbs	
29	Turn signal switch	
30	Fuel level sender	
31	Instrument panel	
32	Outside temperature sensor	
33	Electric fan	
34	Electric fan remote control switch	
35	Oil pressure sensor	
36	Engine temperature sensor	
37	Fuel pump	
38	Fuel injector	
39	Lambda probe	
40	Spark plug	
41	H.V. coil	
42	Electronic injection control unit	

Key

Or: Orange **Lb:** Light Blue **Wh**: White **Bl**: Blue **Ye:** Yellow **Gr:**Grey

Br:Brown **Bl:** Black **Pi**: Pink **Re:** Red **Gre**: Green **Pu:** Purple

Lo schema sottostante è valido per i telai dal numero ZAPM4510000001007 al ZAPM4510000001578. Per i telai successivi consultare la pagina 2.



ELECTRICAL SYSTEM

	Specification	Desc./Quantity
1	Flywheel magneto	
2	Voltage regulator	
3	Immobiliser antenna	
4	Diagnostic inlet	
5	Engine rpm sensor	
6	Engine stop switch	
7	N° 2 fuse boxes in under helmet compartment	
8	Ignition key-switch	
9	Saddle opening button	
10	Injection load remote control	
11	Saddle opening actuator	
12	Glove compartment fuse box	
13	Battery	12 V - 12 Ah

	Specification	Desc./Quantity
14	Starter motor	
15	Starter remote control	
16	Starter button	
17	Rear stop light switch	
18	Stop switch on front brake	
19	Horn button	
20	Horn	
21	Headlight remote control switch	
22	Rear Headlights	**A** Stop light **B** Parking light **C** License plate light
23	Light switch	
24	Front Headlights	**A** Parking light **B** High beam/low beam
25	Anti-theft alarm fitting	
26	helmet compartment button prewiring	
27	Intercom fitting	
28	Turn indicator bulbs	
29	Turn signal switch	
30	Fuel level sender	
31	Instrument panel	
32	Outside temperature sensor	
33	Electric fan	
34	Electric fan remote control switch	
35	Oil pressure sensor	
36	Engine temperature sensor	
37	Fuel pump	
38	Fuel injector	
39	Lambda probe	
40	Spark plug	
41	H.V. coil	
42	Electronic injection control unit	

Key

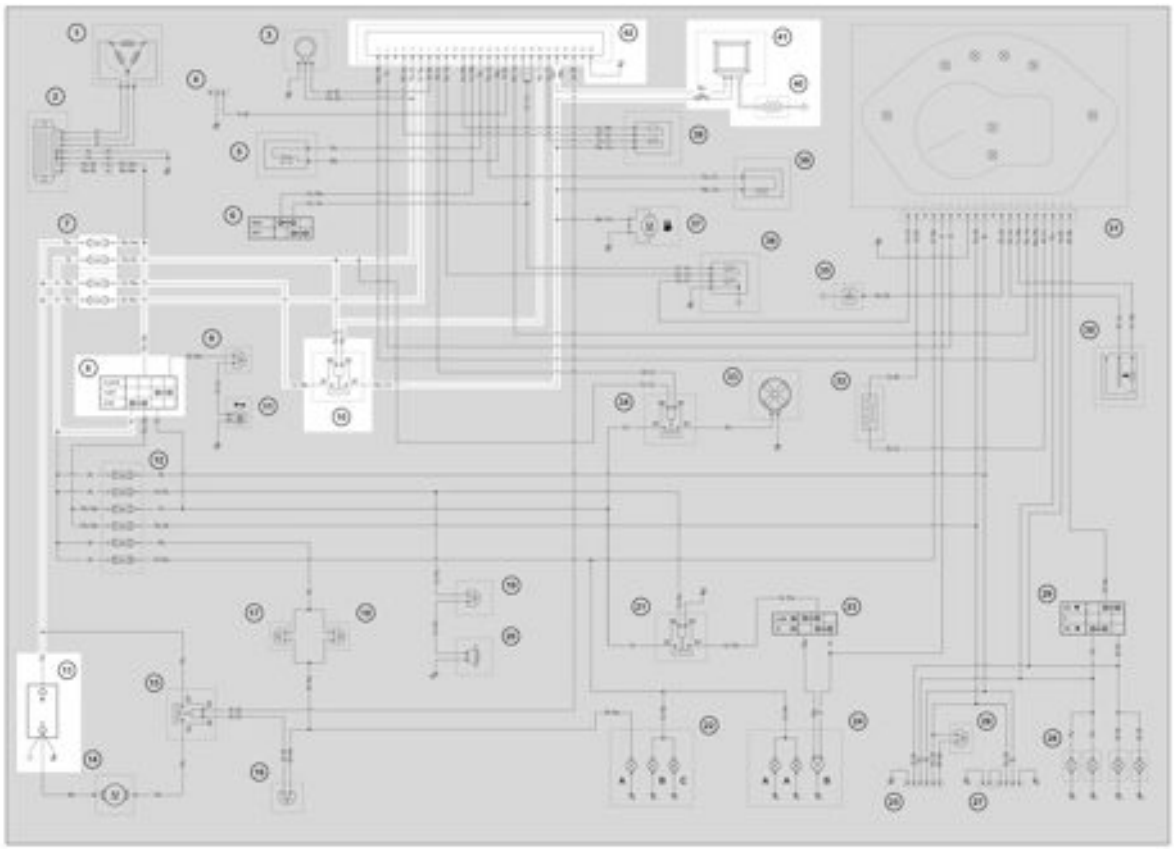
Or: Orange **Lb:** Light Blue **Wh**: White **Bl**: Blue **Ye:** Yellow **Gr:**Grey

Br:Brown **Bl:** Black **Pi**: Pink **Re:** Red **Gre**: Green **Pu:** Purple

Conceptual diagrams

Ignition

Schema valido dal numero di telaio ZAPM4510000001579 in poi.



IGNITION

7. N° 2 fuse boxes in under helmet compartment

8. Key switch

10. Injection charge contactor

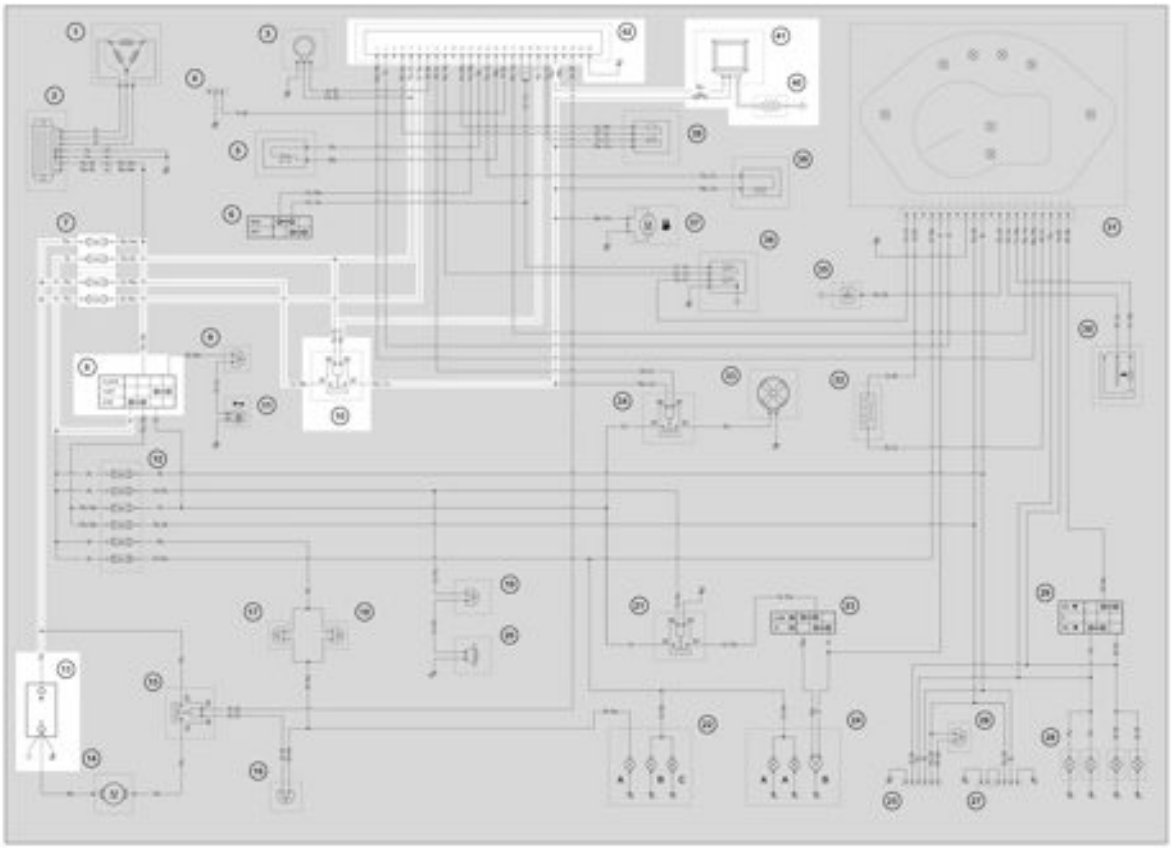
13. Battery

40. Spark plug

41. High voltage coil

42. electronic injection cpu

Lo schema sottostante è valido per i telai dal numero ZAPM4510000001007 al ZAPM4510000001578. Per i telai successivi consultare la pagina 2.



IGNITION

7. N° 2 fuse boxes in under helmet compartment

8. Key switch

10. Injection charge contactor

13. Battery

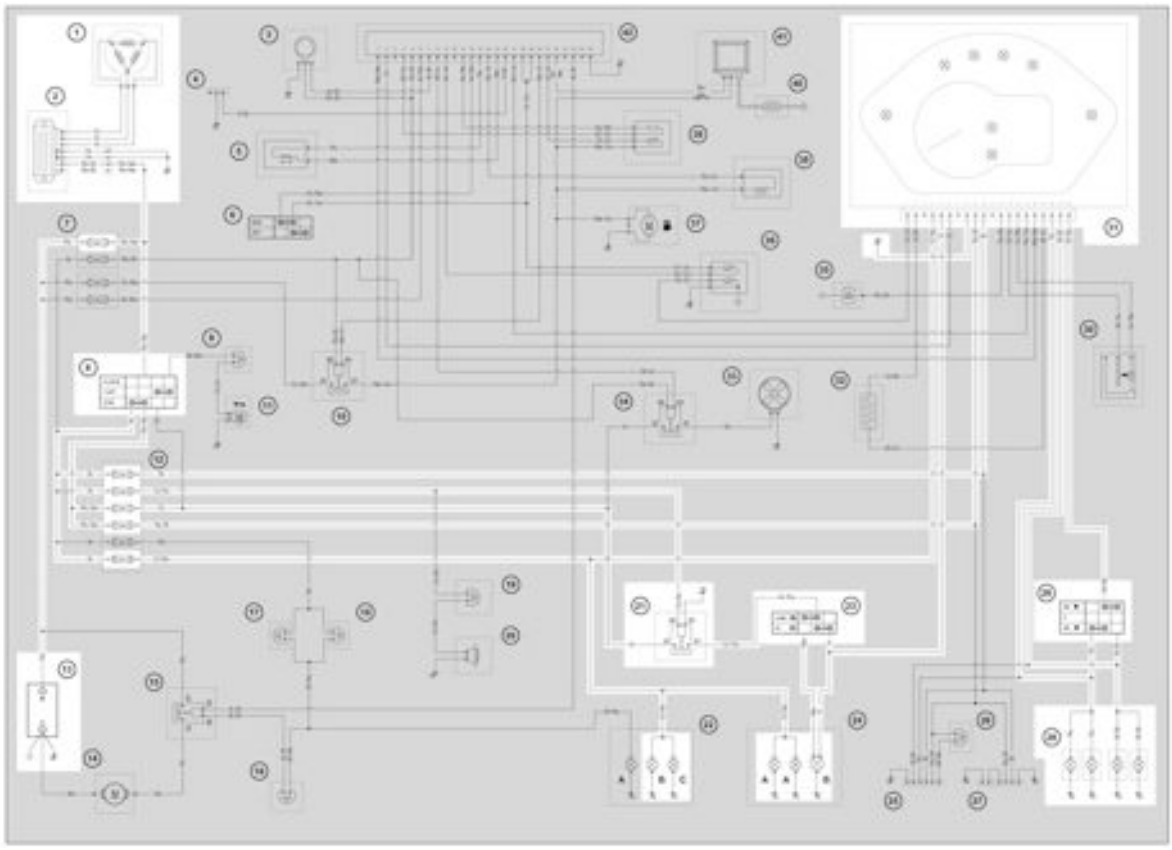
40. Spark plug

41. High voltage coil

42. electronic injection cpu

Headlights and automatic starter section

Schema valido dal numero di telaio ZAPM4510000001579 in poi.



LIGHTS AND TURN INDICATORS

1. Magneto

2. Voltage regulator

7. N° 2 fuse boxes in under helmet compartment

8. Key switch

12. Glove compartment fuse box

13. Battery

21. Light contactor

22. Rear lights

A Stop light

B Parking light

C License plate light

23. High/low beam selector

24. Headlights

A Parking light

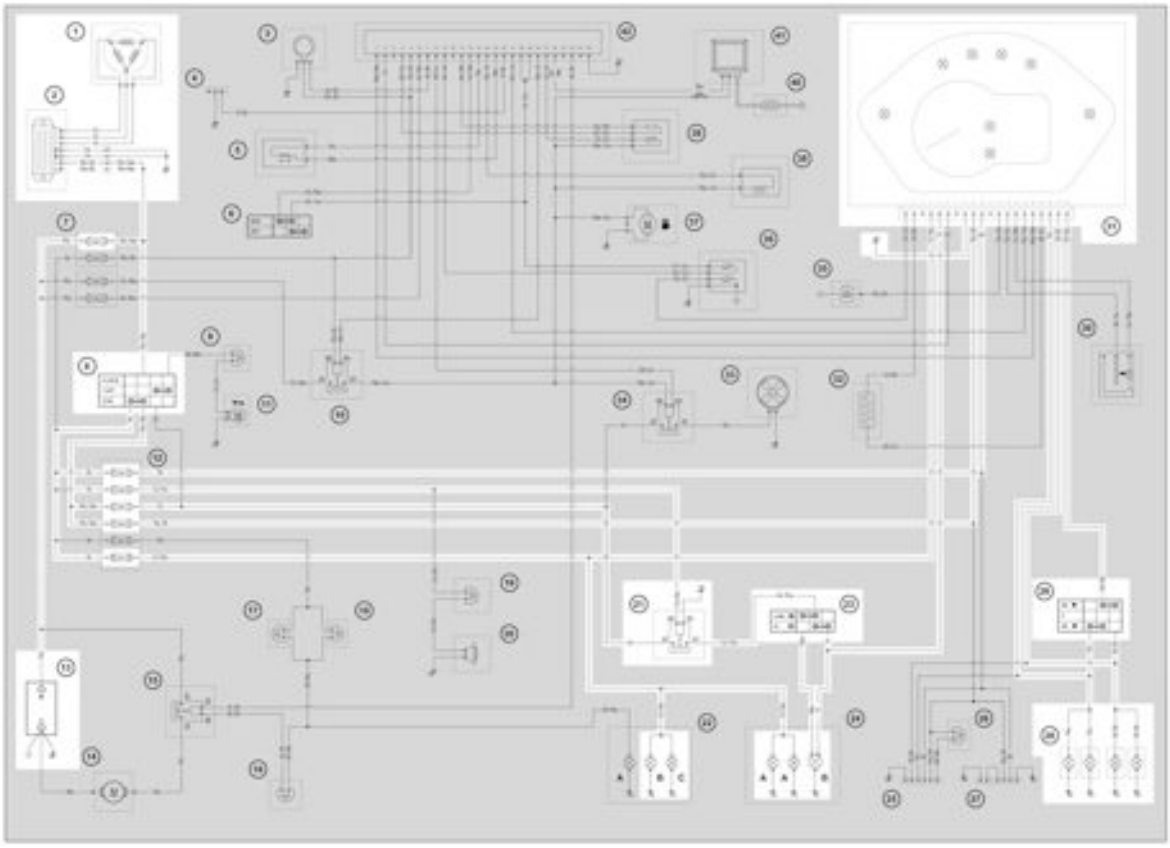
B High beam/low beam

28. Turn indicator bulbs

29. Turn indicator switch

31. Instrument panel

Lo schema sottostante è valido per i telai dal numero ZAPM4510000001007 al ZAPM4510000001578. Per i telai successivi consultare la pagina 2.



LIGHTS AND TURN INDICATORS

1. Magneto

2. Voltage regulator

7. N° 2 fuse boxes in under helmet compartment

8. Key switch

12. Glove compartment fuse box

13. Battery

21. Light contactor

22. Rear lights

A Stop light

B Parking light

C License plate light

23. High/low beam selector

24. Headlights

A Parking light

B High beam/low beam

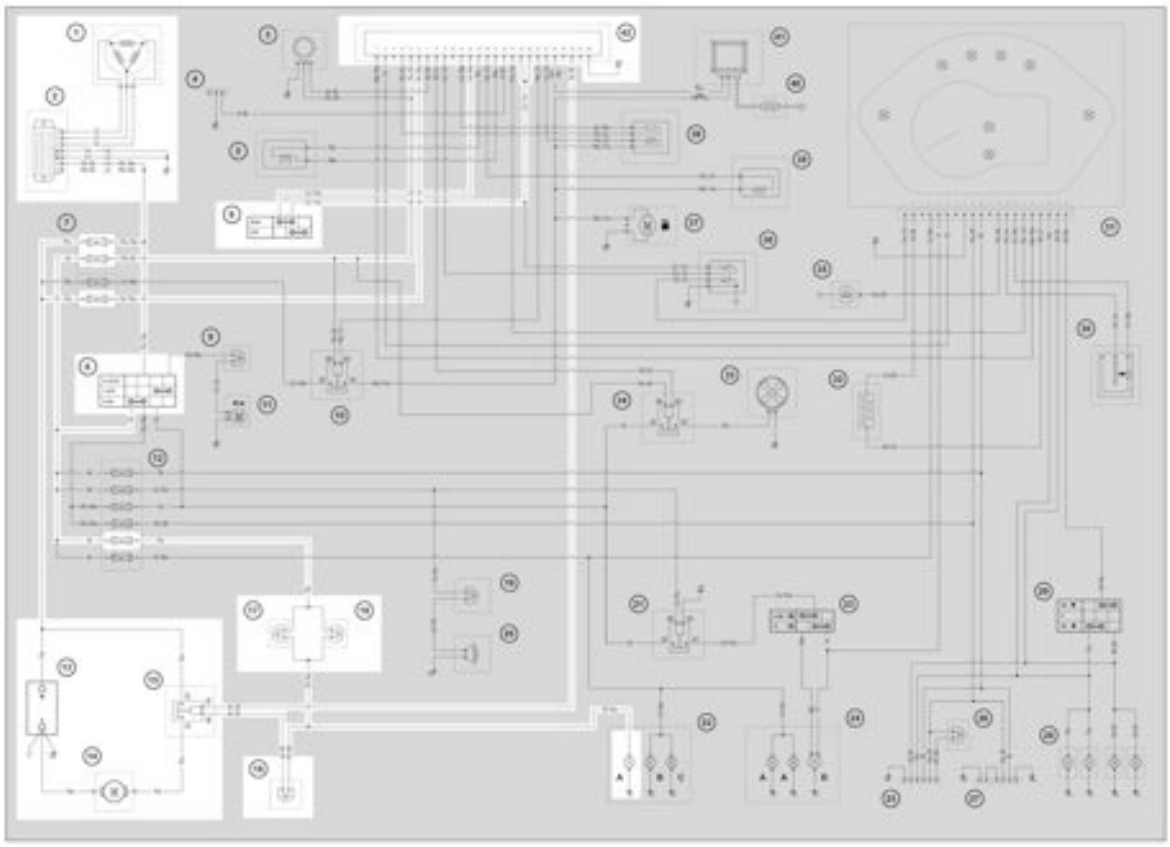
28. Turn indicator bulbs

29. Turn indicator switch

31. Instrument panel

Battery recharge and starting

Schema valido dal numero di telaio ZAPM4510000001579 in poi.



BATTERY CHARGER AND STARTING

1. Magneto

2. Voltage regulator

6. Engine stop switch

7. N° 2 fuse boxes in under helmet compartment

8. Key switch

12. Glove compartment fuse box

13. Battery

14. Starter motor

15. Starter contactor

16. Starter button

17. Rear brake stop button

18. Front brake stop button

22. Headlights

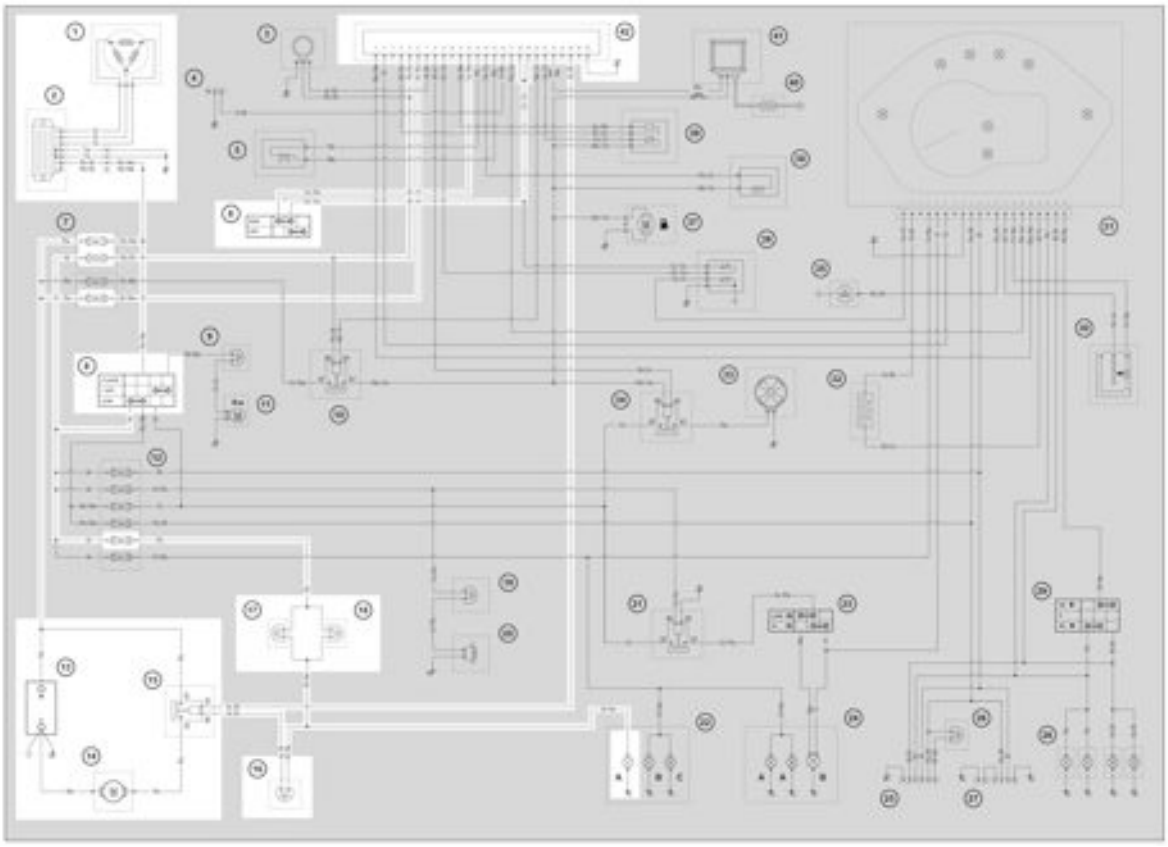
A Stop light

B Parking light

C License plate light

42. Electronic injection cpu

Lo schema sottostante è valido per i telai dal numero ZAPM4510000001007 al ZAPM4510000001578. Per i telai successivi consultare la pagina 2.



BATTERY CHARGER AND STARTING

1. Magneto

2. Voltage regulator

6. Engine stop switch

7. N° 2 fuse boxes in under helmet compartment

8. Key switch

12. Glove compartment fuse box

13. Battery

14. Starter motor

15. Starter contactor

16. Starter button

17. Rear brake stop button

18. Front brake stop button

22. Headlights

A Stop light

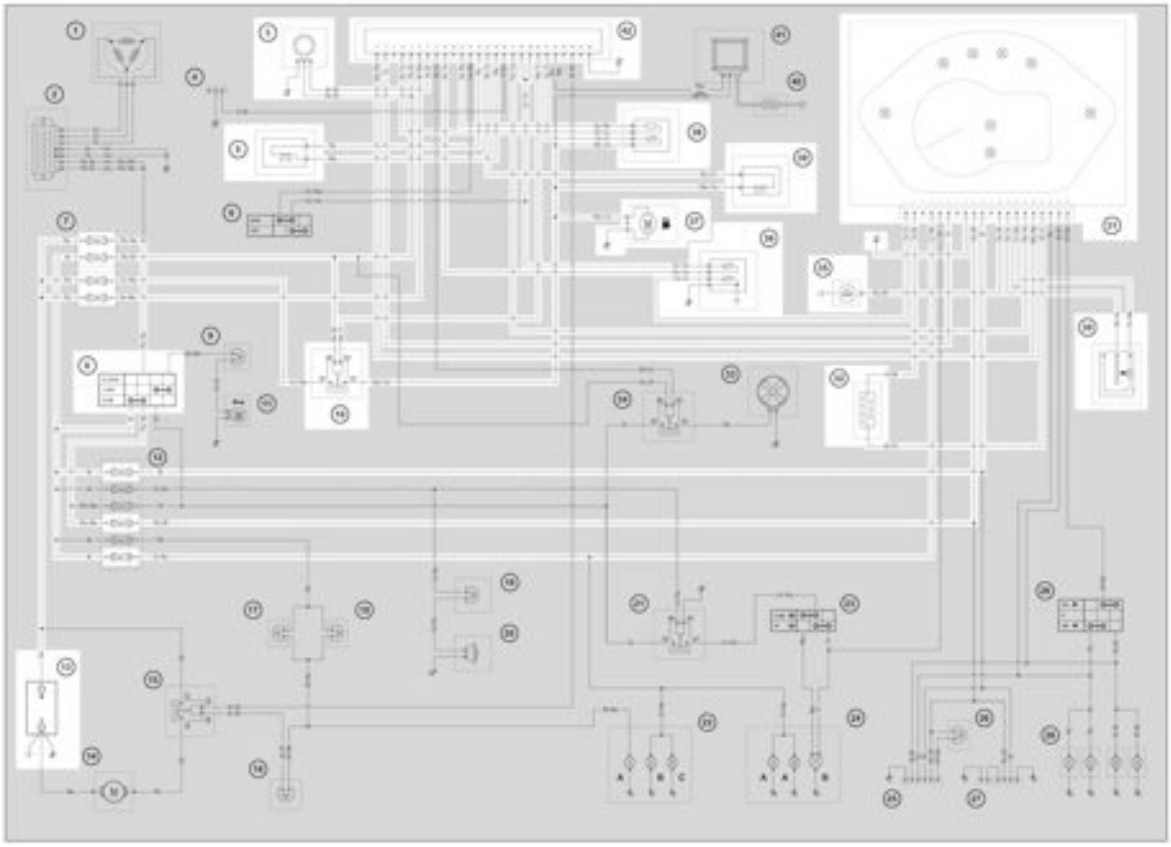
B Parking light

C License plate light

42. Electronic injection cpu

Level indicators and enable signals section

Schema valido dal numero di telaio ZAPM4510000001579 in poi.



CONSENSUSES AND LEVEL INDICATORS

3. Immobilizer antenna

5. Engine rpm sensor

7. N° 2 fuses boxes in under helmet compartment

8. Key switch

10. Injection charge contactor

12. Glove compartment fuse box

13. Battery

30. Fuel level transmitter

31. Instrument panel

32. External temperature sensor

35. Oil pressure sensor

36. Engine temperature sensor

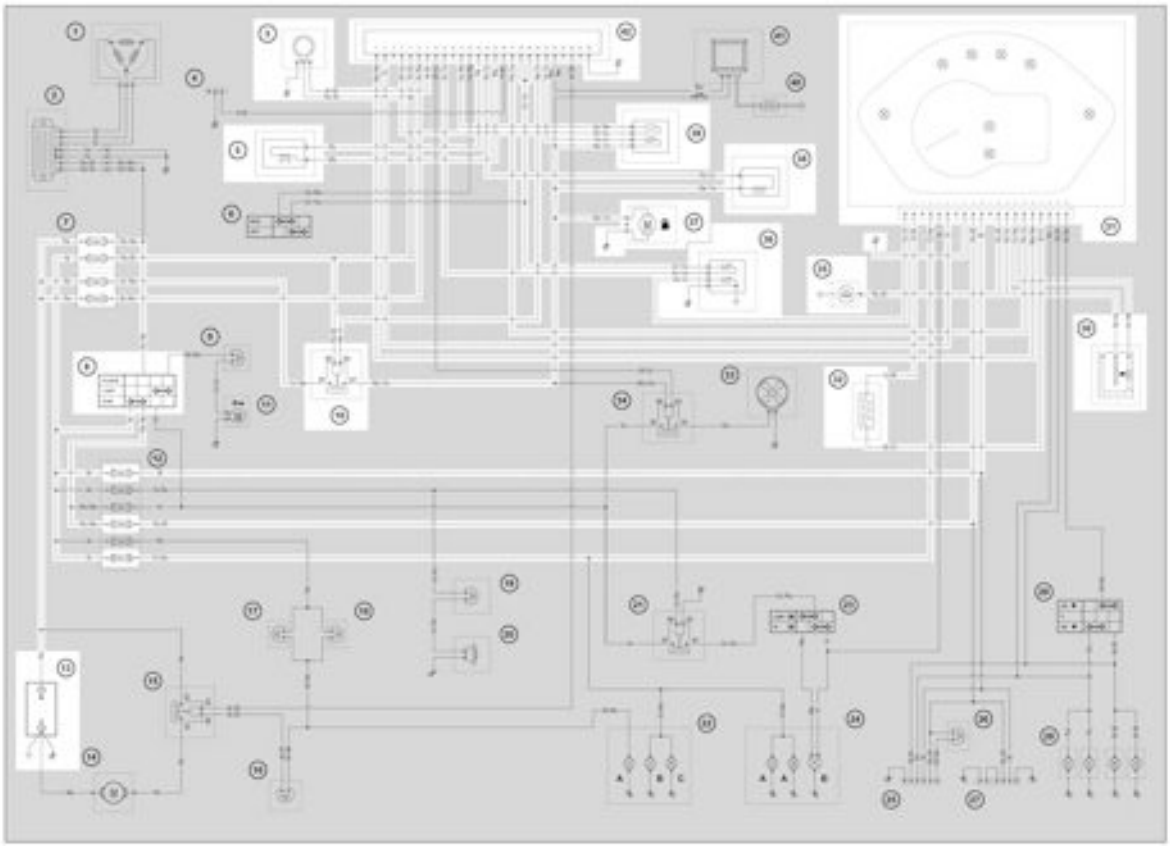
37. Fuel pump

38. Petrol injector

39. Lambda sensor

42. Electronic injection cpu

Lo schema sottostante è valido per i telai dal numero ZAPM4510000001007 al ZAPM4510000001578. Per i telai successivi consultare la pagina 2.



CONSENSUSES AND LEVEL INDICATORS

3. Immobilizer antenna

5. Engine rpm sensor

7. N° 2 fuses boxes in under helmet compartment

8. Key switch

10. Injection charge contactor

12. Glove compartment fuse box

13. Battery

30. Fuel level transmitter

31. Instrument panel

32. External temperature sensor

35. Oil pressure sensor

36. Engine temperature sensor

37. Fuel pump

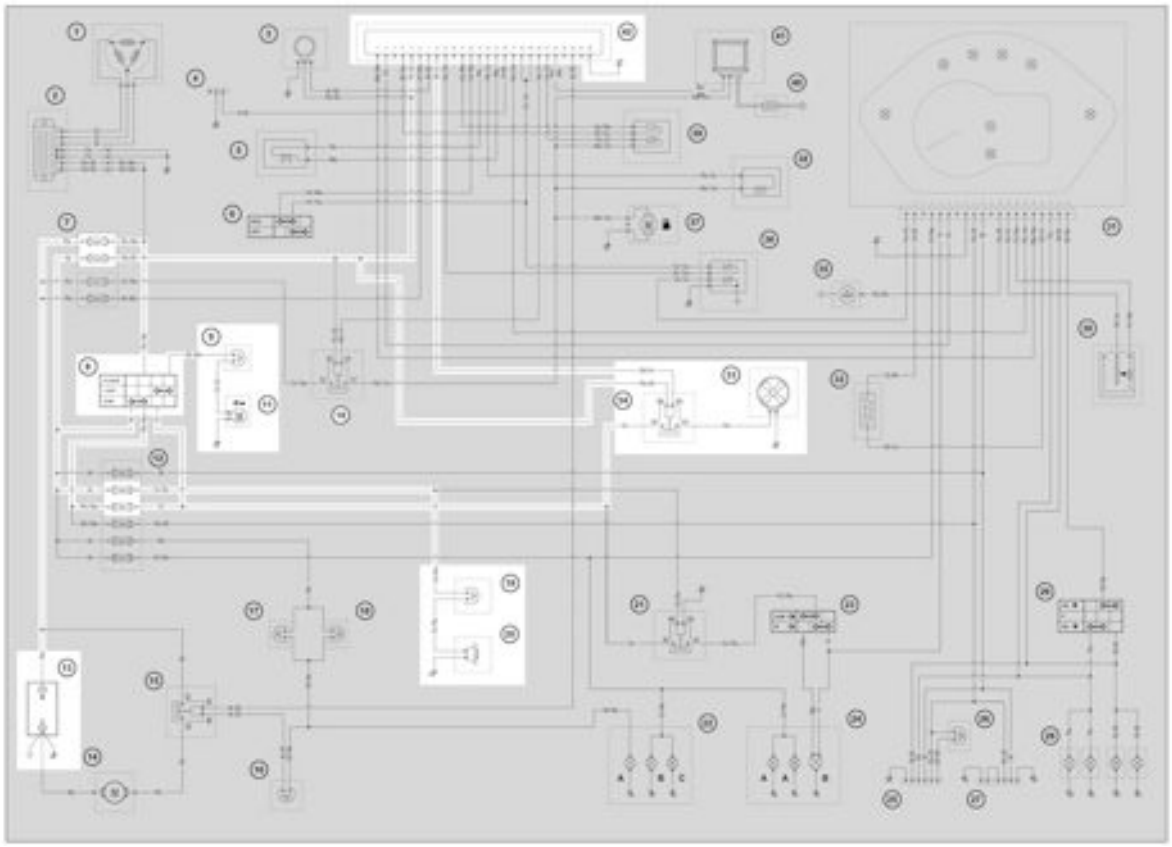
38. Petrol injector

39. Lambda sensor

42. Electronic injection cpu

Turn signal lights

Schema valido dal numero di telaio ZAPM4510000001579 in poi.



DEVICES AND HORN

7. N° 2 fuse boxes in under helmet compartment

8. Key switch 9. Saddle open button

10. Injection charge contactor

11. Actuator for saddle opening

13. Battery

19. Horn button

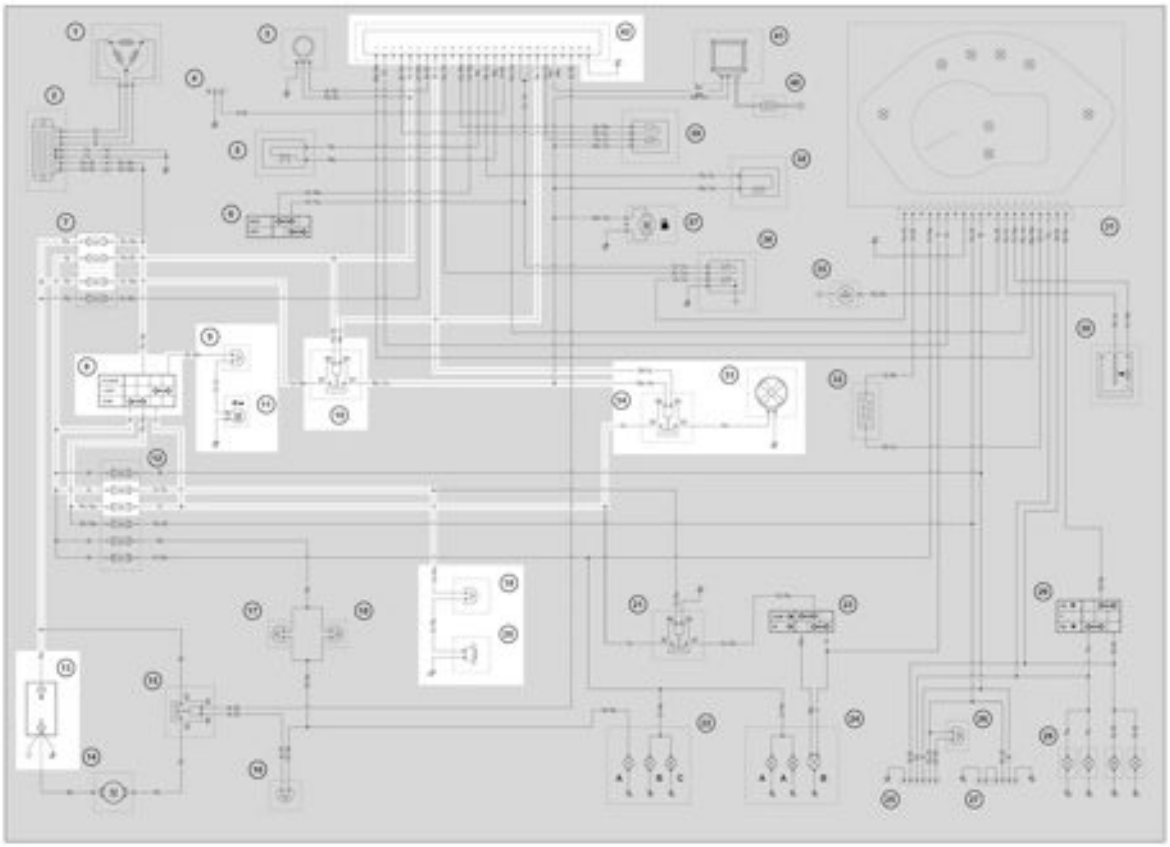
20. Horn

33. Electric fan for ventilator

34. Electric fan contactor

42. Electronic injection cpu

Lo schema sottostante è valido per i telai dal numero ZAPM4510000001007 al ZAPM4510000001578. Per i telai successivi consultare la pagina 2.



DEVICES AND HORN

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10. Injection charge contactor

11. Actuator for saddle opening

13. Battery

19. Horn button

20. Horn

33. Electric fan for ventilator

34. Electric fan contactor

42. Electronic injection cpu

Checks and inspections

This section is devoted to the checks on the electrical system components.

Immobiliser

The electronic ignition system is managed by the cpu with a built-in Immobilizer system. The Immobilizer is an anti-theft system which only lets the vehicle run if it is started with coded keys which are recognized by the cpu. The code is integrated in a transponder built in the key body. This permits transparent operation for the driver who only needs to turn the key. The Immobilizer system is composed of the following components:

-cpu

-immobilizer antenna

-master key and spare key with built-in transponder

-H.V. coil

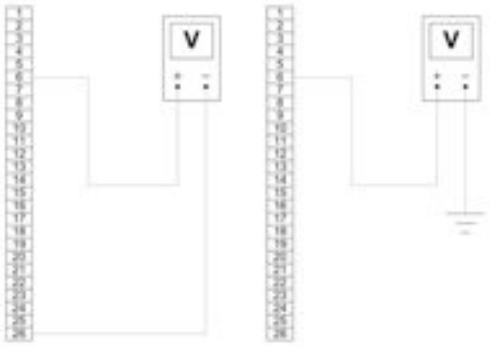
-diagnostic led

The diagnostic led also acts as a deterrent. This function is obtained each time the key switch is positioned on "OFF" or if the emergency switch is put on "OFF" and it stays on for 48 hours in order not to affect the battery charge.

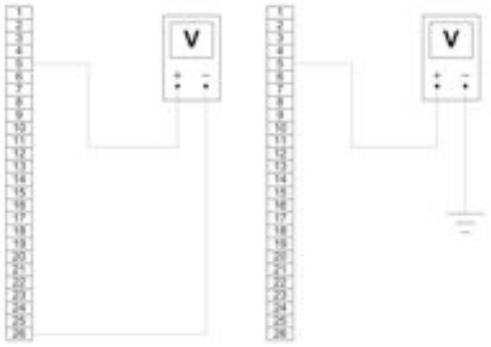
When the key switch is turned to "ON" the deterrent light function stops and a light goes on

confirming changeover to "ON".
The duration of this light varies based on the cpu programming.
If the led is off no matter what the position of the key switch or the instrument panel is not initialised, check:
• battery voltage
• working order of fuse no. 1 and fuse no. 8.
Remove the connector support bracket as indicated in the photo and disconnect the connector from the cpu. Check the following conditions:

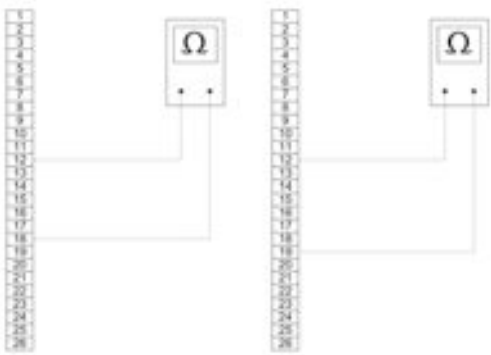
With key switch on OFF:
presence of battery voltage between terminals 6-26 and chassis earth terminal 6 (fixed power supply). If there is no voltage check the working order of fuse no. 4 and related wiring.



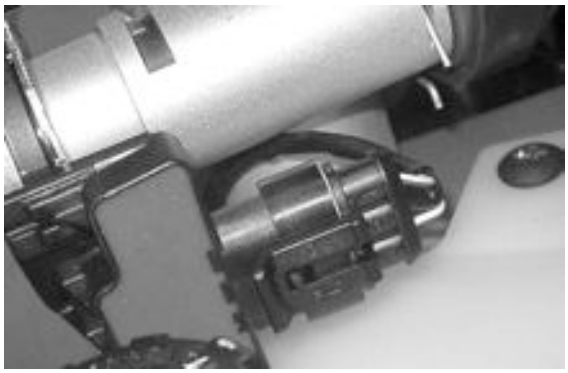
With key switch on ON:
presence of battery voltage between terminals 5-26 and chassis earth terminal 5 (under panel supply). If there is no voltage check the key switch contacts, working order of fuse no. 2 and related wiring.



• Presence of continuity between terminals 12-18 and 12-19 with the emergency stop switch in the RUN position. If there is no continuity check the contacts of the latter.
If no faults are found replace the cpu.



After removing the shield back plate, remove the electrical connection from the aerial as shown in the photograph



Remove the protective base from the connector.

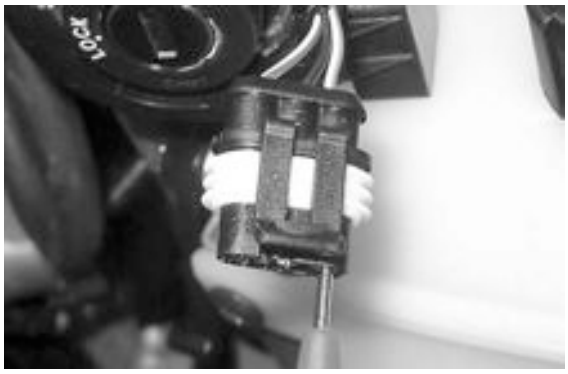
With the ignition key switch at ON check there is battery voltage between the Red-White and Black cables

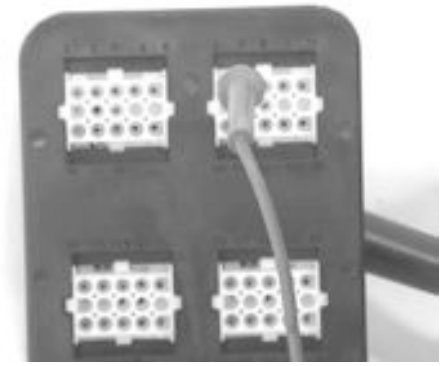
With MIU connector disconnected check the continuity between the Orange-White cable and pin 7 of the interface wiring .

Specific tooling

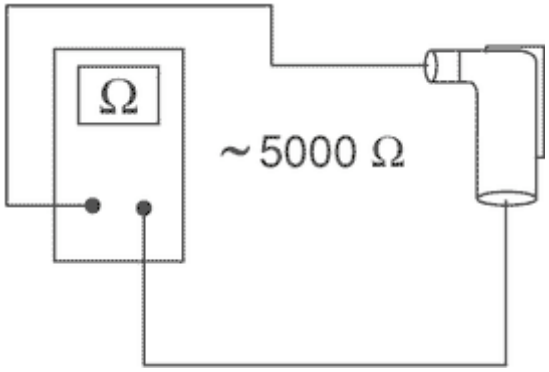
020481Y Control unit interface wiring

020331Y Digital multimeter





Virgin circuit



When the ignition system is not coded, any key can be used to run the engine but limited to 2000 rpm. Recognition of the key is only possible when the cpu is correctly programmed.

The memorization procedure for a new cpu entails recognition of the red key (Master key) as the first key to memorise: this is particularly important as it is the only key which can cancel or reprogram the cpu for memorizing the spare key.

To code the system the Master key and spare key must be used as follows:

- Insert the Master key, switch to «ON» and keep it in this position for 2 seconds (limit values 1-3 seconds).
- Insert the blue key switching to «ON» for 2 seconds.
- Repeat the operation with each duplicate key.
- Insert the Master key again switching to «ON» for 2 seconds.

The maximum time available for passing from one key to the next is 10 seconds.

A maximum number of 7 spare keys (blue) can be memorized.

It is indispensable to comply with the times and procedures, otherwise the procedure needs to be

started from the beginning.
Once the system has been programmed, an inseparable combination is created between the master key transponder with the decoder and cpu.
By maintaining this combination it is possible to program the spare keys for losses, replacements etc. Each new programming cancels the previous one, therefore to add or eliminate a key, it is indispensable to repeat the procedure using all the keys which will be spares.
If the memory is lost for one of the spare keys, carefully check the effectiveness of the high voltage system shielding. The use of resistive spark plugs is recommended.

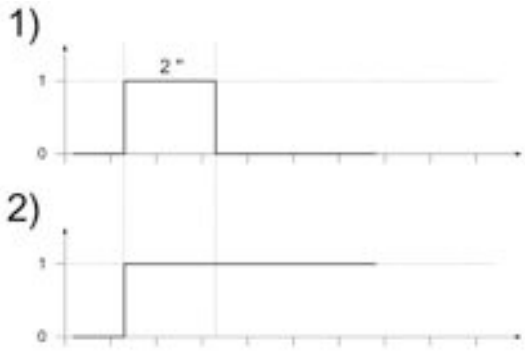
Characteristic

Shielded cap resistance

~ 5000 Ω.

Diagnostic codes

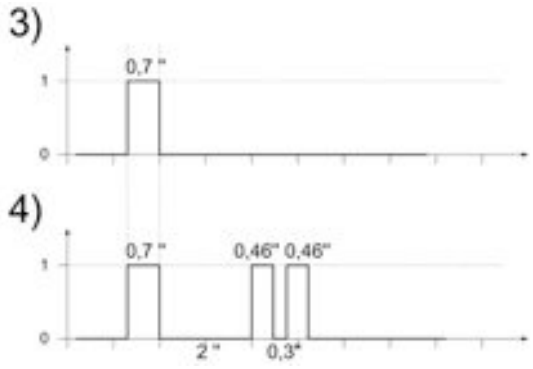
The immobiliser system is tested each time the ignition-key switch is turned from OFF to ON. During this diagnostics phase a number of control unit statuses can be seen and various light codes displayed. Regardless of the code transmitted, if at the end of the diagnosis the LED remains off permanently, the ignition is enabled. If, however, the LED remains on permanently, it means the ignition is inhibited:



1. Previously unused control unit - key in: a single 2 second flash is displayed, after which the LED remains off permanently. The keys can be stored to memory, the scooter can be started but with a limitation imposed on the number of revs.

2. Previously unused control unit - transponder absent or cannot be used: the LED is on permanently. In this condition no operations are possible including the start up of the scooter.

3. **Programmed control unit - the service key in (normal condition of use)**: a single 0.7 second flash is displayed, after which the LED remains off permanently. The engine can be started.



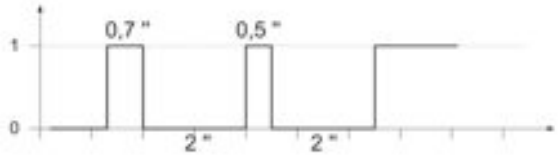
4. **Programmed control unit - Master key in**: a 0.7 sec. flash is displayed followed by the LED remaining off for 2 sec. and then by short 0.46 sec. flashes the same number of times as there are keys stored in the memory including the Master key. Once the diagnosis is complete, the LED remains off permanently. The engine can be started.

5. Programmed control unit - fault detected: a light code is displayed according to the fault detected, after which the LED remains on permanently. The engine cannot be started. The codes that can be transmitted are:

- 1 flash code
- 2 flash code
- 3 flash code

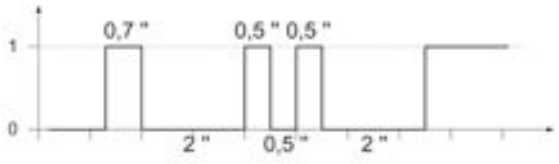
Diagnostic code - 1 flash

Code 1 flash signifies a system where the serial line is not present or not recognised. Check the wiring of the immobilizer aerial and replace, if necessary.



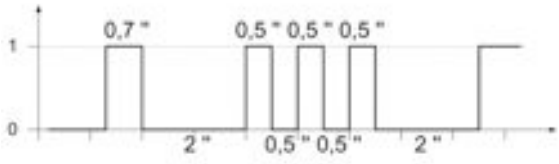
Diagnostic code - 2 flashes

Two-flash code shows a system where the control unit does not show the transponder signal. This might depend on the inefficiency of the immobiliser aerial or the transponder.
Turn the switch to ON using several keys: if the code is repeated even with the Master key, check the aerial wiring and change it if necessary. If this is not the case, replace the defective key and/or reprogram the control unit. Replace the control unit if the problem continues.



Diagnostic code - 3 flashes

The three-flash code indicates a system where the control unit does not recognise the key. Turn the switch to ON using several keys: if the error code is repeated even with the Master key, replace the control unit. If this is not the case, perform a reprogramming.



Battery recharge circuit

The charging circuit consists of three-phase generator and a permanent magneto flywheel.
The generator is directly connected to the voltage regulator.
This, in its turn, is connected directly to the ground and the battery's positive terminal passing through the 30A protective fuse.
The three- phase generator provides good recharge power and at low revs a good compromise is achieved between generated power and idle stability.

Stator check

Checking the stator windings

WARNING

THIS TEST CAN BE EFFECTED WITH THE STATOR NORMALLY INSTALLED.

1) Lift the saddle and remove the helmet compartment

2) Disconnect the connector between the stator and regulator with three yellow wires as shown in the photo.

3) Measure the resistance between each of the yellow terminals and the other two.

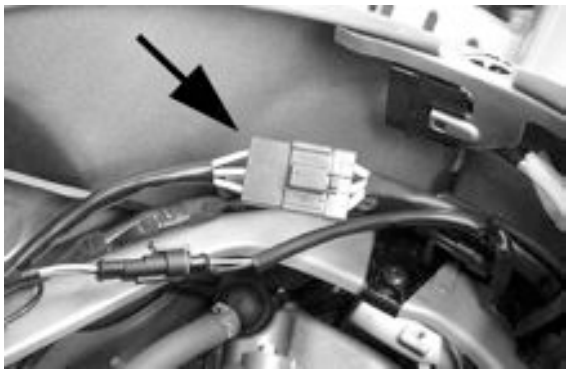
Electric characteristic

Resistance:

0.2 - 1 Ω

4) Check that there is insulation between the each yellow cable and the earth.

5) If values that are wrong are noted, replace the stator.



Recharge system voltage check

Searching for dispersion

1) Remove the cover of the footrest to access the battery.

2) make sure the battery is not leaking fluid before checking the output voltage.

3) Turn the ignition key to the OFF position, connect the tester terminals between the negative pole (-) of the battery and the Black wire and then separate the Black wire from the battery negative (-) pole.

4) With the still on OFF, the reading on the ammeter must be = 0.5 mA.

Charging voltage check

WARNING

BEFORE CARRYING OUT THE CHECK, MAKE SURE THAT THE BATTERY IS IN GOOD WORKING ORDER.

1) Rest the scooter on the centre stand.

2) With the battery properly connected to the circuit, place the tester terminals between the battery poles.

3) Start the engine, ensure that the lights are all out, increase the engine speed and at the same time measure the voltage.

Electric characteristic

Voltage between 14.0 and 15.0 V at 5000 rpm.

Maximum current supplied check

- With engine off and panel set to "ON" turn on the lights and let the battery voltage set to 12V.
- Connect ammeter pliers to the 2 recharge positive poles in output from the regulator.
- Keep the lights on and start the engine, bring it to normal speed and read the values on the ammeter.

If the battery is efficient, the value should be: > 20A

VOLTAGE REGULATOR/RECTIFIER

Specification	Desc./Quantity
Type	Non-adjustable tri-phase transistor
Voltage	14 - 15V a 5000 rpm with lights off

Turn signals system check

The turn indicator circuit is supplied by the instrument panel. If it does not work it is necessary to:

1. make sure the lamps are working
2. make sure fuse 8 is working
3. with the key switch in ON and without disconnecting the instrument panel connector, check for intermittent voltage between terminal 20 and the earth.

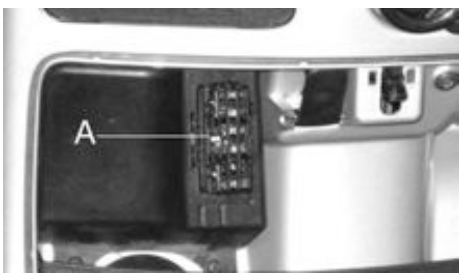
• If there is voltage present check for the presence of voltage on the turn indicator selector as well. If this is powered replace the selector, otherwise check the selector-instrument panel connection wiring.

• If there is no voltage disconnect the connector and check for voltage between the terminals 9-8 and 9-earth (test battery fixed positive) and between terminals 10-8 and 10-earth (test key on positive). If there is no voltage check the circuit wiring. Otherwise replace the instrument panel.

Fuses

The electrical systems is equipped with:

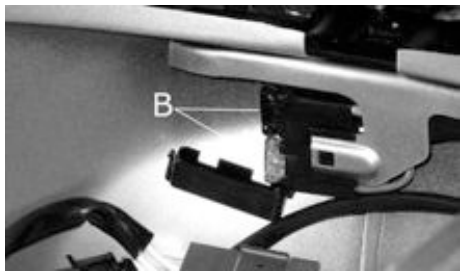
1. six «**A**» fuses located in the glove compartment on the left
2. two «**B**» fuses located under the helmet compartment under the saddle hinge.
3. two «**C**» fuses located under the helmet compartment on the left

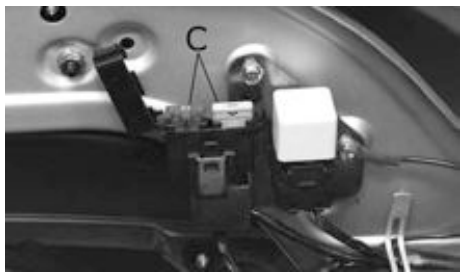


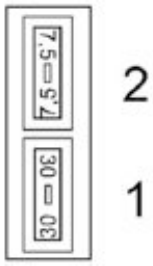
The table shows the position and specifications of the fuses on the vehicle.

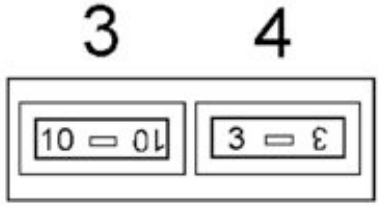
CAUTION

BEFORE REPLACING THE BLOWN FUSE, TRY TO ELIMINATE THE FAULT THAT HAS CAUSED IT TO BLOW.
NEVER TRY TO REPLACE A FUSE USING DIFFERENT MATERIAL (FOR EXAMPLE A PIECE OF ELECTRIC WIRE) OR A FUSE WITH A HIGHER AMPERAGE THAN THAT INDICATED.







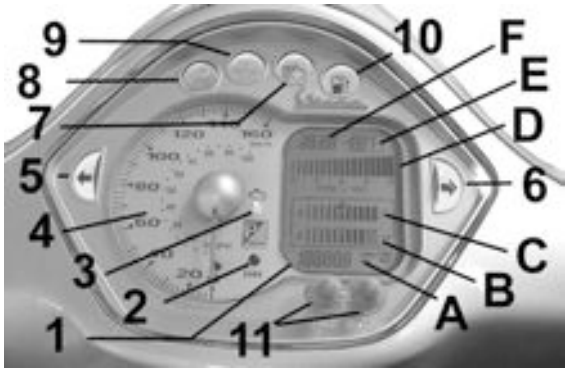


FUSES

	Specification	Desc./Quantity
1	General	**Position on fuse holder:** 1 **Fuse**: 30 A **Protected circuits:** General
2	Ignition ECU	**Fuse box arrangement**: 2 **Fuse capacity**: 7,5 A **Protected circuits**: Ignition ECU
3	Injection loads relay	**Fuse box arrangement**: 3 **Fuse capacity**: 10 A **Protected circuits**: Injection loads relay
4	Injection ECU	**Fuse box arrangement**: 4 **Fuse capacity**: 3 A **Protected circuits**: Injection ECU
5	Dashboard lighting, intercom and anti-theft device pre-wiring	**Fuse box arrangement**: 5 **Fuse capacity**: 10 A **Protected circuits**: Dashboard lighting, intercom and anti-theft device pre-wiring
6	High and low-beam lights, horn	**Fuse box arrangement**: 6 **Fuse capacity**: 7,5 A **Protected circuits**: High and low-beam lights, horn

	Specification	Desc./Quantity
7	High and low-beam lights, electric seat opening	**Fuse box arrangement**: 7 **Fuse capacity**: 15 A **Protected circuits**: High and low-beam lights, electric seat opening
8	Dashboard Fuel supply, intercom and anti-theft device pre-wiring	**Fuse box arrangement**: 8 **Fuse capacity**: 10 A **Protected circuits**: Dashboard Fuel supply, intercom and anti-theft device pre-wiring
9	Starter motor, stop light	**Fuse box arrangement**: 9 **Fuse capacity**: 7,5 A **Protected circuits**: Starter motor, stop light
10	Front and rear side lights, dashboard lighting	**Fuse box arrangement**: 10 **Fuse capacity**: 7,5 A **Protected circuits**: Front and rear side lights, dashboard lighting

Dashboard



1. Digital instrument panel

A. odometer

B. coolant temperature indicator

C. fuel level indicator

D. rpm counter

E. external temperature indicator

F. digital clock

2. Immobilizer led

3. Engine run lamp and injection fault indication

4. Speedometer

5. Left turn indicator lamp

6. Right turn indicator lamp

7. High beam lamp

8. Light lamp

9. Oil pressure warning lamp

10. Fuel reserve warning lamp

11. Clock setting buttons

INSTRUMENT PANEL CONNECTOR

Specification	Desc./Quantity
1. Engine water temperature	
2. External temperature positive	
3. "K" line not connected	
4. Panel lighting	
5. High beam indicator lamp	
6. Engine rpms (injection)	
7. Engine rpms	
8. Instrument earth	
9. Battery positive	
10. Key positive	
11. ABS lamp	
12. Oil pressure warning lamp	
13. Petrol level indicator positive	
14. Petrol level indicator negative	
15. Immobilizer lamp	
16. Injection lamp	
17. External temperature negative	
18. Left turn indicator lamp	
19. Right turn indicator lamp	
20. Turn indicator power	

Sealed battery

If the scooter is provided with a sealed battery, the only maintenance required is the check of its charge and recharging, if needed.

These operations should be carried out before delivering the scooter, and on a six-month basis for storage with open circuit.

Besides upon pre-delivery it is therefore necessary to check the battery charge and recharge it, if required, before storing the scooter and afterwards every six months.

INSTRUCTIONS FOR THE RENEWAL RECHARGE AFTER OPEN-CIRCUIT STORAGE

1) Voltage check

Before installing the battery on the scooter, perform an open-circuit voltage check using a conventional tester.

- If voltage exceeds 12.60 V, the battery may be installed without any renewal recharge.
- If voltage is below 12.60 V, a renewal recharge is required as explained in 2).

2) Constant-voltage battery instructions

- Constant voltage charge equal to 14.40 to 14.70V
- Initial charge current equal to 0.3 - 0.5 x rated capacity
- Charge time:

10 to 12 h recommended

Minimum 6 h

Maximum 24 h

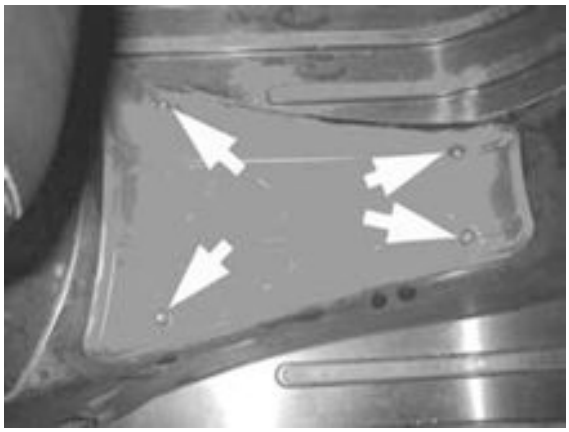
3) Constant-current battery instructions

- Charge current equal to 1/10 of the battery rated capacity
- Charge time: Maximum 5 h

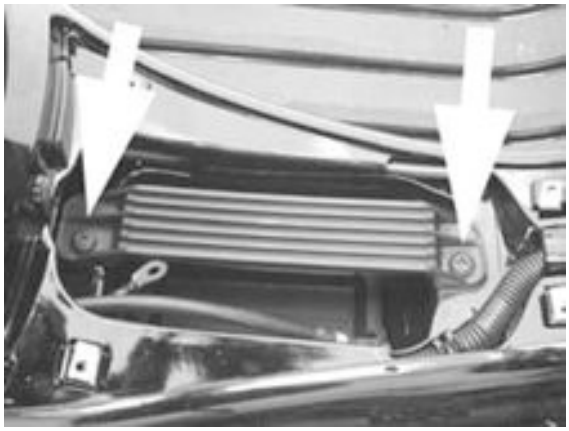
Battery installation

- Remove the battery cover by the 4 screws

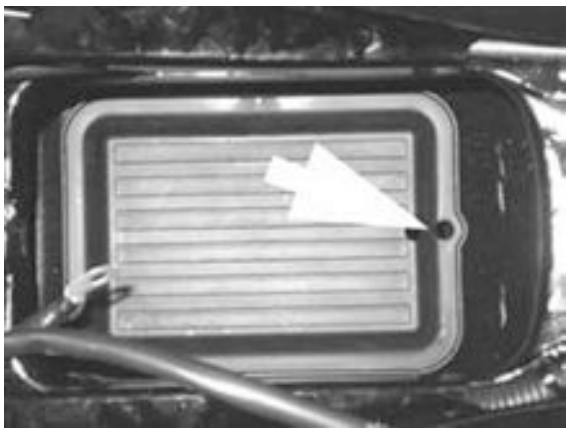
shown in the figure



- Remove the battery fixing clamp



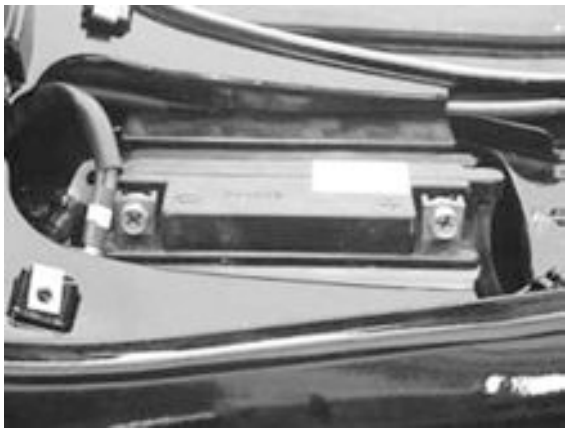
- Use the hole shown in the figure to insert the battery vent tube

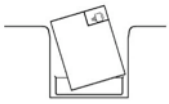


- Insert the battery as shown in the figure.

N.B.

IN ORDER TO FIT THE CABLES ON THE BATTERY TERMINALS CORRECTLY, REST THE LOWER END OF THE TERMINAL SIDE OF THE BATTERY ON THE EDGE OF THE BATTERY WELL.



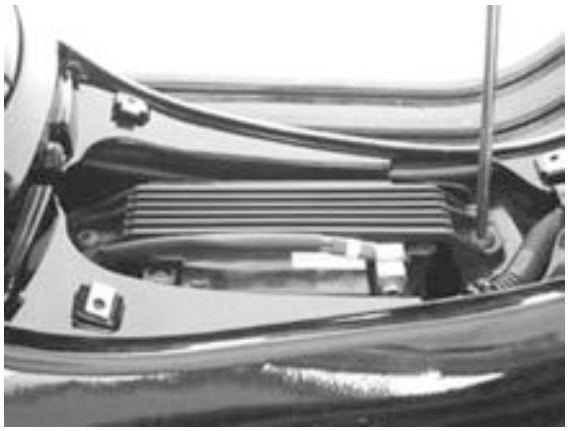


- Using the screwdriver, tighten up the battery terminal cables as far as they will go, placing the special grover washer between the screw head and the cable terminal.

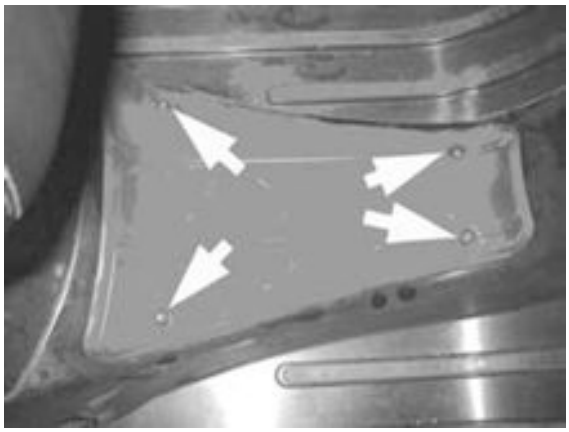
N.B.

DO NOT USE WRENCHES TO TIGHTEN UP THE SCREWS FOR FIXING THE TERMINALS TO THE BATTERY TERMINALS

- Finally insert the battery into the battery holder basin
- Replace the battery fixing clamp



- Refit the battery cover



Connectors

INDEX OF TOPICS

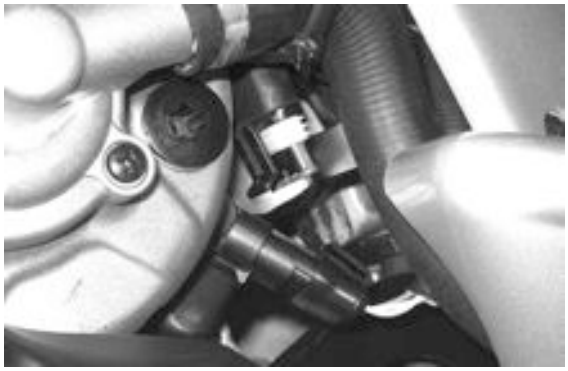
ENGINE FROM VEHICLE	ENG VE

Questa sezione descrive le operazioni da effettuare per lo smontaggio del motore dal veicolo.

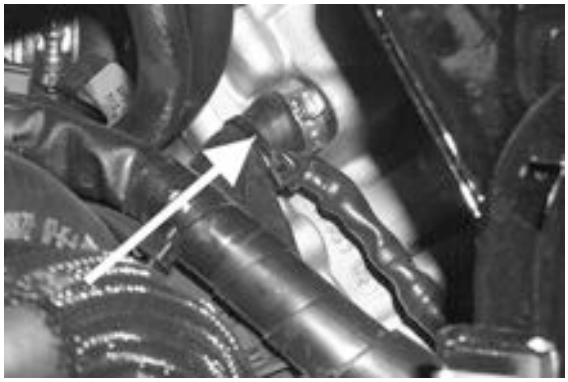
Exhaust assy. Removal

- Remove the right and left side panels and spoiler ends.

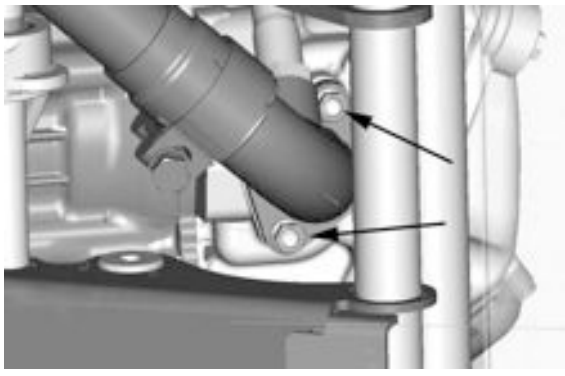
- Remove the lambda probe from its support and disconnect it.



Rimuovere la fascetta di ritegno cavetto sonda lambda dal tubo liquido di raffreddamento indicata in foto



- Undo the two exhaust manifold fixings on the head. To undo the nuts fixing the muffler flange to the head properly, you must use a jointed wrench that enables you to get at the right nut as well, according to the direction of travel, that is difficult to get at with a traditional straight wrench.



- Undo the three screws fixing the muffler to the support arm.
Remove the full muffler assembly.

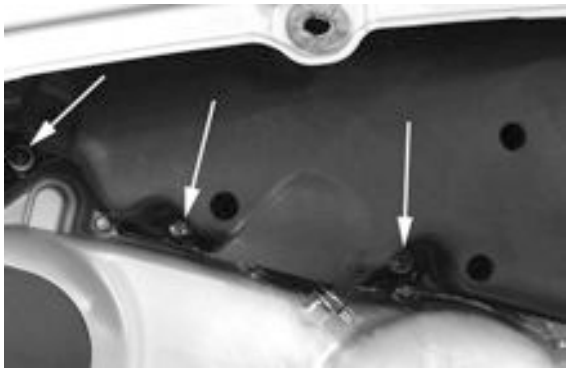
Remove the Lambda probe from the manifold.

Removal of the engine from the vehicle

- Disconnect the battery
- Remove the helmet compartment
- Remove the side panels and spoiler ends.
- Remove the entire muffler
- Remove the purifier box using the 3 screws indicated in the photo.

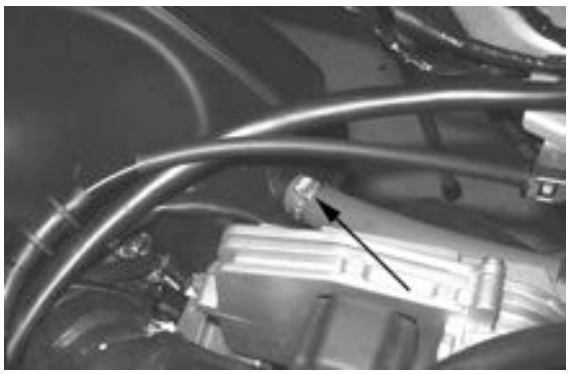
CAUTION

THIS OPERATION SHOULD BE CARRIED OUT ON COLD ENGINE.



-Remove the band from the blow-by tube and disconnect it.

- Remove the band indicated in the photo and disconnect the rubber hose connected to the throttle.



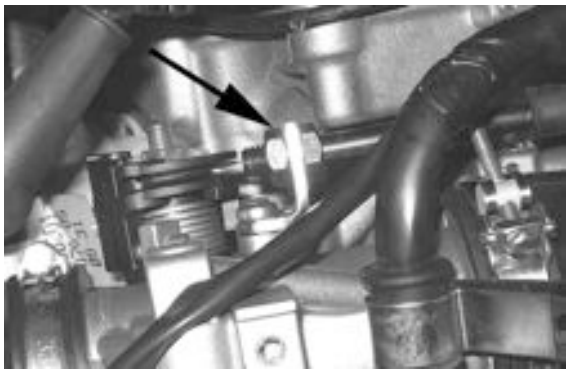
Remove the coolant inlet hose to the pump as shown in the photo.

- Disconnect the fuel delivery and return pipes from the injector by removing the screw locking the retaining clip.
- Disconnect the injector wiring and the throttle body control unit wiring.

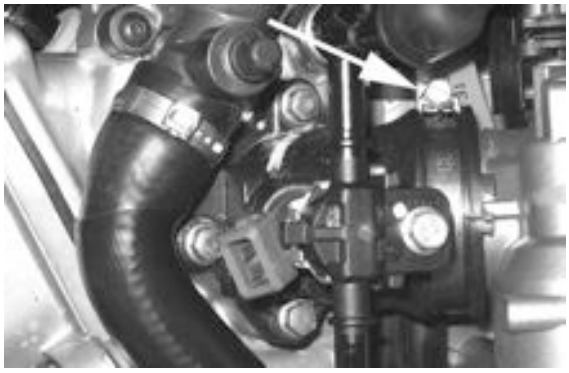
- Remove the coolant outlet pipe from the motor as indicated.

- Remove the spark plug hood.
- Remove the coolant temperature sensor connector indicated in the photo.

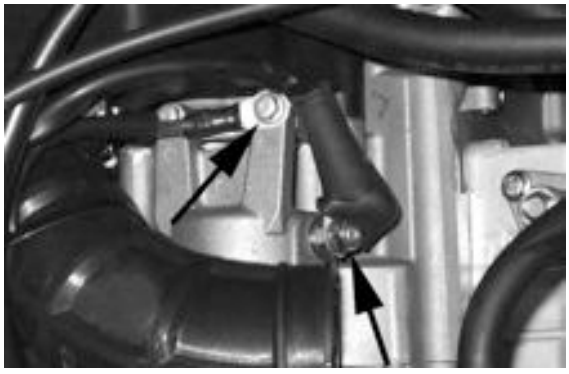
- Remove the throttle cable from the throttle body by undoing the nut shown in the photo.



- Loosen the band indicated in the photo and remove the throttle.



- Remove the positive and negative wiring from the starter motor as shown in the photo.

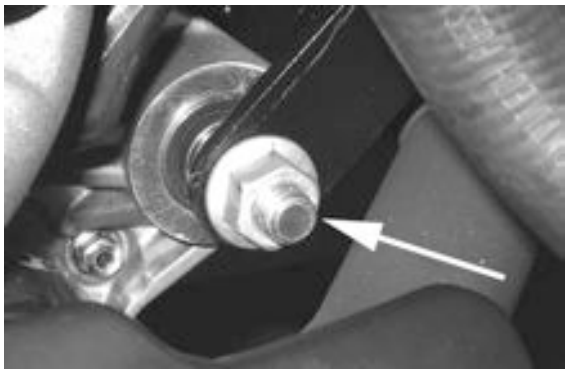


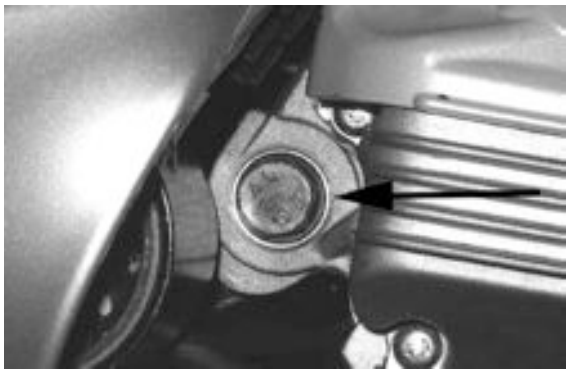
- Disconnect the connectors from the flywheel wiring as shown in the photo.
- Remove the cable from the retaining clip on the

flywheel cover.

- Remove the rear shock absorbers.
- Remove the rear brake calliper hoses using the screw shown in the photo. Then remove the screws securing the hose to the crankcase shown in the photo.

- Use a jack to support the scooter properly. Remove the engine-swinging arm fixing pin by undoing the nut and the head of the pin as shown in the photograph.
- The engine is now free.





When reassembling the engine carry out the operations in the opposite order and observe the prescribed torques listed in the Specifications Ch. Check for the presence of a minor play with the valve completely on the adjusting screw

- Check the engine oil level and fill with the recommended type if needed.
- Fill the coolant circuit and the rear brake circuit.
- Test the operation of the accelerator and the electrical devices.
- Pay particular attention to the band supporting the purifier - throttle connection bellows which must be positioned as in the photo.

CAUTION

BE VERY CAREFUL TO ENSURE THAT THE GAS CONTROL TRANSMISSION IS IN PROPER POSITION.

INDEX OF TOPICS

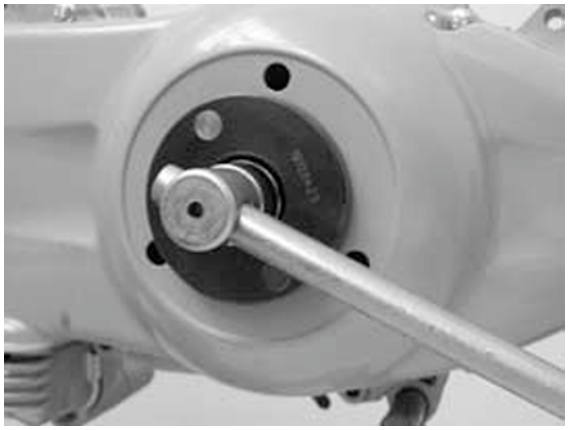
ENGINE	ENG

This section describes the operations to be carried out on the engine and the tools required

Automatic transmission

Transmission cover

- To remove the transmission cover it is necessary to remove the plastic cover first, by inserting a screwdriver in the slotted holes. Using the clutch bell lock wrench shown in the figure, remove the driven pulley shaft locking nut and washer.



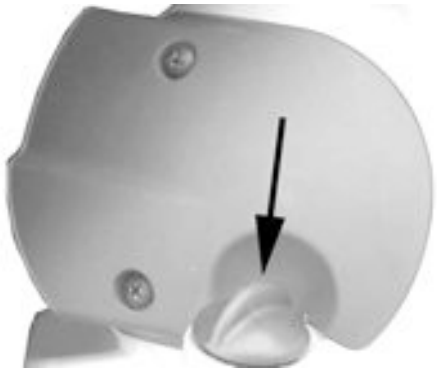
Specific tooling

020423Y driven pulley stop wrench

- Remove the cap/dipstick from the engine oil filling hole.
- Remove the ten screws.
- Remove the transmission cover.

N.B.

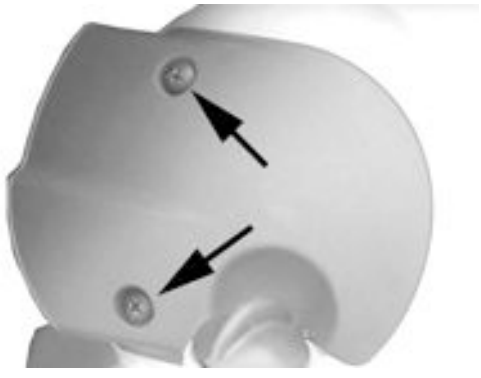
WHEN YOU ARE REMOVING THE TRANSMISSION COVER YOU MUST BE CAREFUL NOT TO DROP THE CLUTCH BELL.



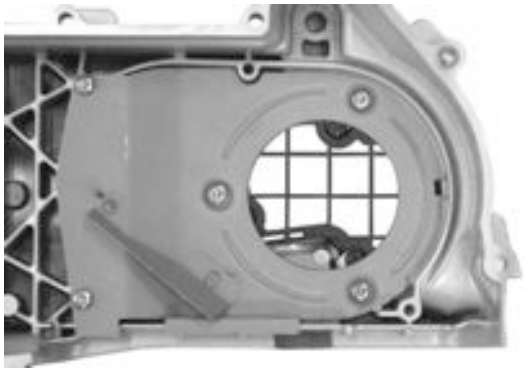
Air duct

Versione 250

- Remove the transmission compartment air intake cover shown in the photograph.

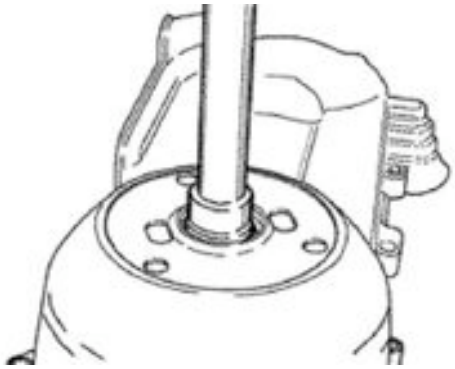


- Remove the five screws on two different levels as well as the small casing.



Removing the driven pulley shaft bearing

- Remove the clip from the inside of the cover.
- Remove the bearing from the crankcase by means of:



Specific tooling

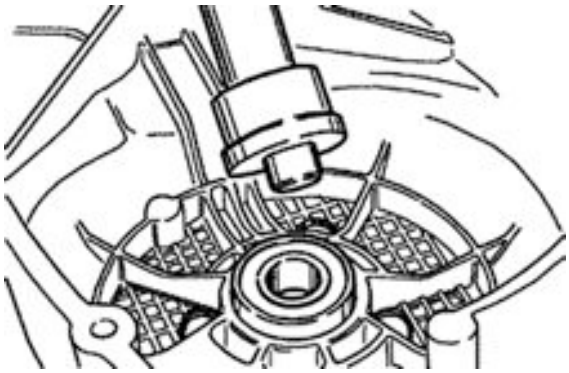
020376Y Handle for adaptors

020375Y Adapter 28 x 30 mm

020412Y 15 mm guide

Refitting the driven pulley shaft bearing

- Slightly heat the crankcase from the inside so as not to damage the painted surface.
- Insert the bearing in its seat.
- Refit the Seeger ring.



CAUTION

USE AN APPROPRIATE REST SURFACE TO AVOID DAMAGING THE COVER PAINT.

N.B.

ALWAYS REPLACE THE BEARING WITH A NEW ONE UPON REASSEMBLY.

Specific tooling

020376Y Handle for adaptors

020357Y 32 x 35 mm adaptor

020412Y 15 mm guide

Baffle roller

Plastic roller

- Check that the roller does not show signs of wear and that it turns freely.
- Remove the special clamping screws as indicated in the photograph

- Check the outer diameter of the roller does not have defects that could jeopardise belt functioning
- For refitting, place the roller with the belt containment edge on the engine crankcase side
- Tighten the wrench to the prescribed torque.

Locking torques (N*m)

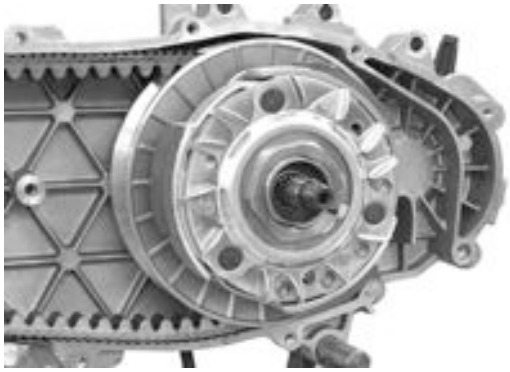
Anti-vibration roller 12 ÷ 16

Removing the driven pulley

- Remove the clutch bell housing and the driven pulley assembly.

N.B.

THE UNIT CAN ALSO BE REMOVED WITH THE DRIVE PULLEY MOUNTED.



Inspecting the clutch drum

- Check that the clutch bell is not worn or damaged.
- Measure the clutch bell inside diameter.

Characteristic

Max. value clutch bell

Max. value: Diameter 134.5 mm

Clutch Bell Standard value

Standard value: Diameter 134 - 134.2 mm

Checking the bell working surface eccentricity

- Install the bell on a driven pulley shaft using 2 bearings (inner diameter 15 and 17 mm).
- Lock using the original spacer and nut.
- Place the bell/shaft assembly on the support to check the crankshaft alignment.

- Using a feeler pin gauge and the magnetic base, measure the bell eccentricity.
- Repeat the measurement in 3 positions (Central, internal, external).
- In case of anomalies, replace the bell.

Specific tooling

020074Y Support base for alignment control of crankshaft

020335Y Magnetic support for gauge

Characteristic

Clutch bell inspection: Limit eccentricity.

Admissible limit eccentricity: 0.15 mm

Removing the clutch

Fit the special driven pulley spring compressor

tool with medium length pins in position **"C"** screwed up from the inner side of the tool.

- Introduce adapter ring n° 11 with the chamfering facing the inside of the tool.
- Fit the driven pulley assembly on the tool with the insertion of the three pins in the ventilation holes in the earth holder support.
- Make sure that the clutch is perfectly inserted into the adapter ring before proceeding to loosen/tighten the clutch nut.
- Use the special 46x55 wrench component n°9 to remove the nut fixing the clutch in place.
- Dismantle the driven pulley components (Clutch and spring with its plastic holder)

CAUTION

THE TOOL MUST BE FIRMLY FIXED IN THE CLAMP AND THE CENTRAL SCREW MUST BE BROUGHT INTO CONTACT WITH THE TOOL. EXCESSIVE TORQUE CAN CAUSE THE APPROPRIATE TOOL TO BUCKLE.

Specific tooling

020444Y011 Adapter ring

020444Y009 Wrench 46 x 55

020444Y Driven half pulley spring compressor fit/removal tool

Inspecting the clutch

- Check the thickness of the clutch mass friction material.
- The masses must not show traces of lubricants; otherwise, check the driven pulley unit seals.

N.B.

UPON RUNNING-IN, THE MASSES MUST EXHIBIT A CENTRAL CONTACT SURFACE AND MUST NOT BE DIFFERENT FROM ONE AN-

OTHER.
VARIOUS CONDITIONS CAN CAUSE THE CLUTCH TO TEAR.

CAUTION

DO NOT OPEN THE MASSES USING TOOLS TO PREVENT A VARIATION IN THE RETURN SPRING LOAD.

Characteristic

Check minimum thickness

1 mm

Pin retaining collar

- Simultaneously turn and pull the collar manually to remove it.

N.B.

USE TWO SCREWDRIVERS IF YOU HAVE DIFFICULTY.

N.B.

BE CAREFUL NOT TO PUSH THE SCREW DRIVERS IN TOO FAR TO AVOID DAMAGE THAT COULD ENDANGER THE O-RING SEAL.

- Remove the four torque server pins and pull the pulley halves apart.

Removing the driven half-pulley bearing

- Check there are no signs of wear and/or noisiness; - Replace with a new one if there are.

- Remove the retaining ring using two flat blade

screwdrivers.

- Support the pulley bushing adequately from the threaded side using a wooden surface.

- Using a hammer and pin, knock the ball bearing out as shown in the figure.

- Support the pulley properly using the bell as shown in the figure.

Specific tooling

001467Y035 Bell for bearing outside diameter 47 mm

- Remove the roller bearing using the modular punch.

Specific tooling

020376Y Handle for adaptors

020456Y diameter 24 mm adaptor

020363Y 20mm guide

Inspecting the driven fixed half-pulley

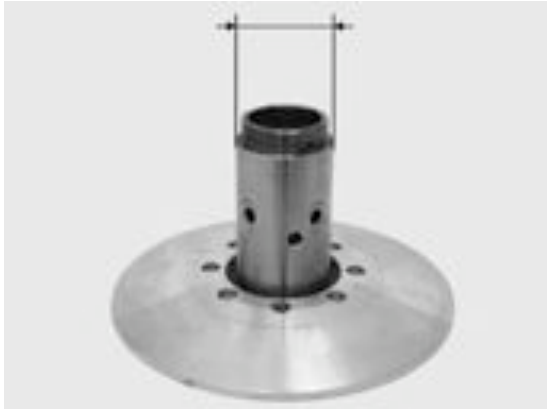
Version 250

- Measure the outer diameter of the pulley bushing.

- Check the contact surface with the belt to make sure there are no flaws.

- Check the riveted joints are functional.

- Check the evenness of the belt contact surface.



Characteristic

Minimum pulley half diameter

Minimum admissible diameter 40.96 mm

Standard pulley half diameter

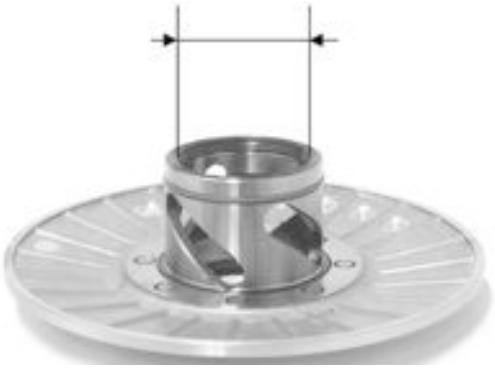
Standard diameter 40.985 mm

Wear limit

0.3 mm

Inspecting the driven sliding half-pulley

- Remove the two internal grommets and the two O-rings.
- Measure the inner diameter of the mobile half-pulley bushing.
- Check the contact surface with the belt to make sure there are no flaws.
- Check the riveted joints are functional.
- Check the evenness of the belt contact surface.



MOVING DRIVEN PULLEY HALF DIMENSIONS

Specification	Desc./Quantity
Wear limit	0.3 mm
Standard diameter	Diameter 41.000 - 41.035 mm
Maximum allowable diameter	41.08 mm

Refitting the driven half-pulley bearing

- Support the pulley bushing adequately from the

threaded side using a wooden surface.

- Fit a new roller sleeve as in the figure.

- For the fitting of the new ball bearing, follow the example in the picture using a modular punch.

Fit the retention ring

N.B.

N.B. Fit the ball bearing with the visible shield

Specific tooling

020376Y Handle for adaptors

020375Y Adapter 28 x 30 mm

020424Y Punch for fitting driven pulley roller casing

Refitting the driven pulley

- Insert the new oil guards and O-rings on the moving pulley half.

- Lightly grease the O-rings O-R (A) shown in the figure.

- Fit the pulley half over the bushing using the appropriate tool

Check that the pins are not worn and proceed with the refitting in the relative hollows.-

- Refit the torque server closure collar.

- Using a curved-spout grease gun, lubricate the driven pulley assembly with approximately 6 gr of grease. Apply the grease through one of the holes in the bushing until it comes out through the hole on the opposite side. This operation is necessary to avoid the presence of grease beyond the O-rings.

N.B.

THE TORQUE SERVER GREASING OPERATION CAN BE DONE BOTH WITH BEARINGS FITTED AND WHEN THEY ARE BEING REPLACED; UNDERTAKING THE OPERATION WHEN THE BEARINGS ARE BEING SERVICED MIGHT BE EASIER.

Specific tooling

020263Y Driven pulley assembly sheath

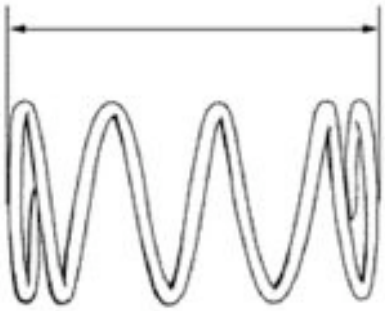
Recommended products

TUTELA MRM 2 Grease for the rotating ring of the tone wheel

Molybdenum disulphide and lithium soap grease

Inspecting the clutch spring

- Measure the length of the spring, while it is relaxed.



Characteristic

Standard length

123 mm

Acceptable limit after use:

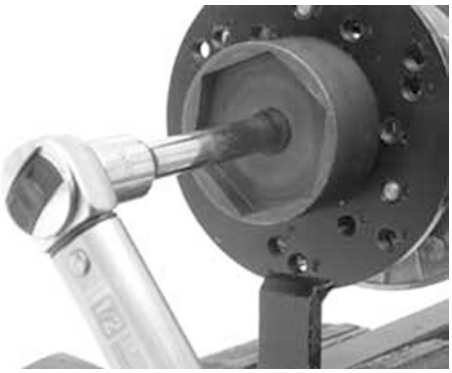
118 mm

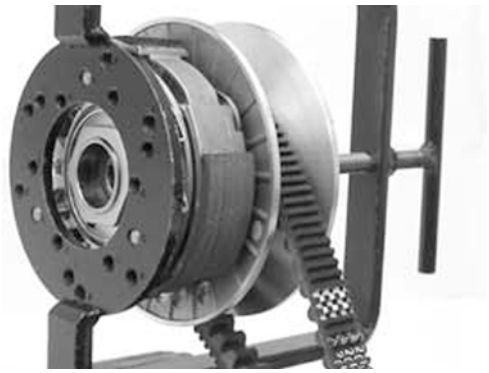
Refitting the clutch

- Support the driven pulley spring compressor appropriate tool with the control screw in vertical axis.
- Arrange the tool with the medium length pins screwed in position "**C**" on the inside.
- Introduce the adapter ring n° 11 with the chamfering facing upwards.
- Insert the clutch on the adapter ring.
- Lubricate the end of the spring that abuts against the servo-system closing collar.
- Insert the spring with relevant plastic holder in

contact with the clutch.

- Insert the driving belt into the pulley unit according to their direction of rotation.
- Insert the pulley unit with the belt into the tool.
- Slightly pre-load the spring.
- Make sure that the clutch is perfectly inserted into the adapter ring before proceeding to tighten the clutch nut.
- Place the tool in the clamp with the control screw on the horizontal axis.
- Fully pre-load the spring.
- Apply the clutch fixing nut and tighten it to the prescribed torque using the special 46x55 wrench.
- Loosen the tool clamp and insert the belt according to its direction of rotation.
- Lock the driven pulley again using the appropriate tool.
- Pre-load the clutch return spring by turning and pulling at the same time and place the belt in the smaller diameter rolling position.
- Remove the driven pulley /belt assembly from the tool.





N.B.

DURING THE SPRING PRE-LOADING PHASE, BE CAREFUL NOT TO DAMAGE THE PLASTIC SPRING STOP AND THE BUSHING THREADING.

N.B.

FOR DESIGN REASONS, THE NUT IS SLIGHTLY ASYMMETRIC; THE FLATTEST SURFACE SHOULD BE MOUNTED IN CONTACT WITH THE CLUTCH.

Specific tooling

020444Y Driven half pulley spring compressor fit/removal tool

020444Y011 Adapter ring

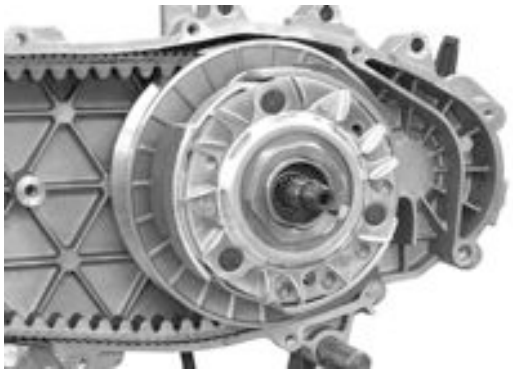
020444Y009 Wrench 46 x 55

Locking torques (N*m)

Clutch assembly nut on driven pulley 45 ÷ 50

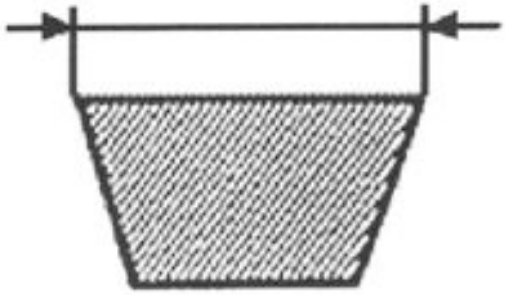
Refitting the driven pulley

- Refit the clutch bell.



Drive-belt

- Check that the driving belt is not damaged.
- Check the width of the belt.



Characteristic

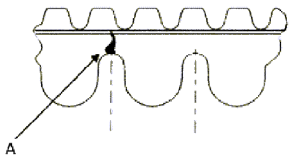
250 4T Transmission belt/minimum width

19.5 mm

250 4T Transmission belt/standard width

21.3 ± 0.2 mm

During the wear checks in the scheduled servicing programme, you are advised to check the rim bottom of the toothing does not show signs of incisions or cracking (see figure): The rim bottom of the tooth must not have incisions or cracking; if it does, change the belt.



Removing the driving pulley

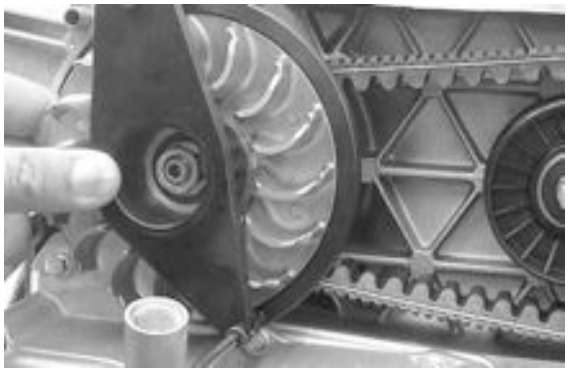
- Turn the crankshaft until the ropes of the pulley are on a horizontal axis

- Insert the adaptor sleeve of the appropriate tool in the hole shown in the photograph

- Insert the tool in the hollows and apply the retention ring
- Bring in the ring's clamping screws while keeping the tool to support the pulley

Specific tooling

020626Y Drive pulley stop wrench



- Remove the fixing nut and the washer
- Remove the stationary drive pulley half.

Inspecting the rollers case

- Check that the internal bushing shown in the fig-

ure is not abnormally worn and measure inner diameter A.

- Measure outer diameter B of the pulley sliding bushing shown in the figure.
- Check that the rollers are not damaged or worn.
- Check the guide shoes for the variator back-plate are not worn.
- Check there is no wear in the roller housing, and the surfaces in contact with the belt on either of the pulley halves.
- Check that stationary drive pulley does not show signs of abnormal wear on the grooved edge and on the surface in contact with the belt.
- Check that the O-ring is not pushed out of shape.

CAUTION

DO NOT LUBRICATE OR CLEAN SINTERED BUSHINGS

Characteristic

Mobile driving half-pulley bushing: Standard diameter

26.000 - 26.021 mm

Mobile driving half-pulley bushing: Maximum allowable diameter

26.12 mm

Sliding bushing: Standard diameter

25.959 - 25.98 mm

sliding bushing: Minimum admissible diameter

25.95 mm

Roller: Standard diameter

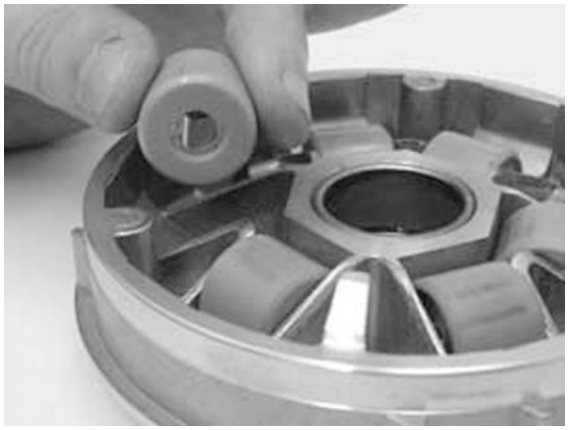
Diameter 20.5 - 20.7 mm

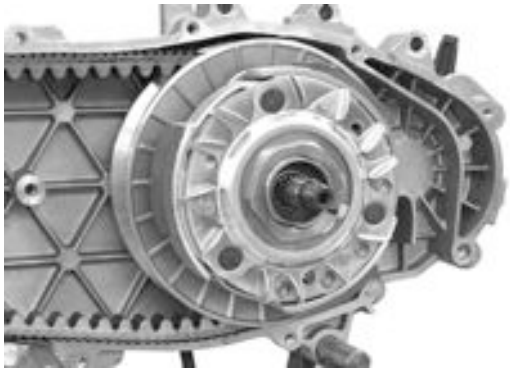
Roller: Minimum admissible diameter

Ø 20 mm

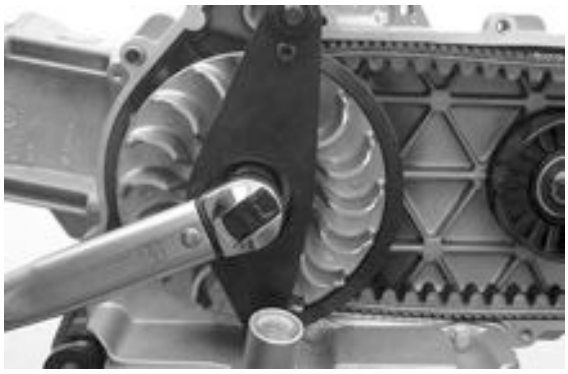
Refitting the driving pulley

- Pre-assemble the moving pulley half with the roller contrast plate by putting the rollers in their housings with the larger support surface touching the pulley according to the direction of rotation.
- Check that the roller contact plate does not have flaws and is not damaged on the grooved edge.
- Mount the complete bushing unit on the driving shaft.
- Fit the driven pulley/Clutch/belt assembly on the engine.





- Fit the steel shim in contact with the bushing and the stationary drive pulley.
- Install the appropriate tool as described in the removal phase.
-Tighten the nut with washer to the prescribed torque.



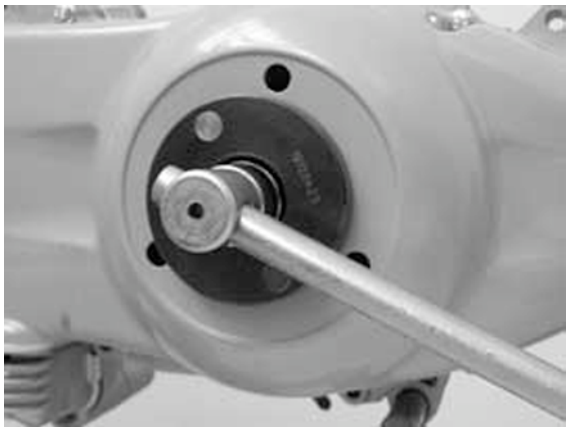
Specific tooling

020626Y Drive pulley stop wrench

Locking torques (N*m)

drive pulley nut 75 ÷ 83

Refitting the transmission cover



- Check the presence of the 2 centring dowels and the correct installation of the sealing gasket for the oil sump on the transmission cover.
- Replace the cover tightening the 10 screws to the prescribed torque.
- Replace the oil loading cap/bar.
- Replace the steel washer and the driven pulley nut.
- Tighten the nut to the prescribed torque using the lock wrench and the torque wrench tools.
- Replace the plastic cover.

Specific tooling

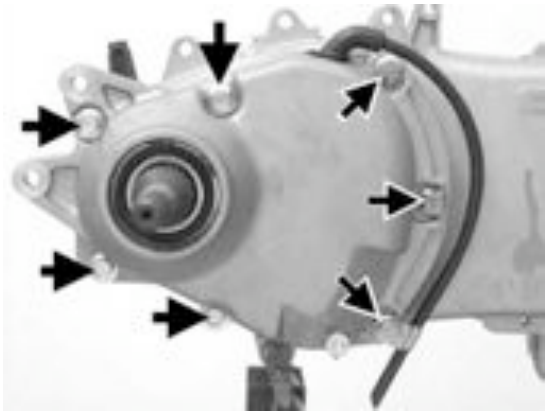
020423Y driven pulley stop wrench

Locking torques (N*m)

Transmission cover screws 11 ÷ 13 Driven pulley shaft nut 54 ÷ 60

End gear

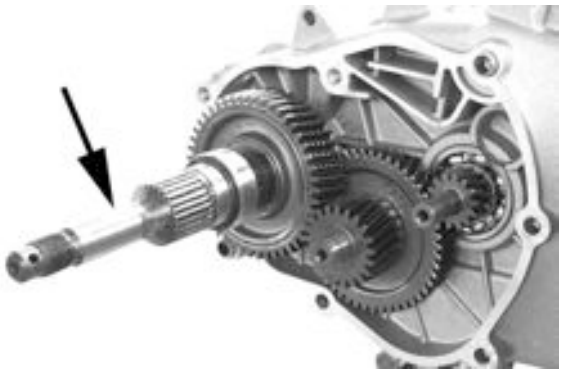
Removing the hub cover



- Empty the rear hub through the oil drainage tap.
- Remove the 7 flanged screws indicated in the figure.
- Remove the hub cover and its gasket.

Removing the wheel axle

- Remove the wheel axis complete with gear.
- Remove the intermediate gear.



Removing the hub bearings

- Check the state of the bearings being examined (wear, clearance and noisiness). If faults are detected, do the following.
- Use the bearing extractor, available as an appropriate tool, to remove the three 15 mm bearings (two in the crankcase and one in the hub cover).

Specific tooling

001467Y013 Extraction pliers for 15 mm diameter bearings

Removing the wheel axle bearings

- Take out the clip on the outside of the gearbox cover.
- Support the hub cover and expel the bearing.

By means of the appropriate tools, remove the oil guard as in the figure.

Specific tooling

020376Y Handle for adaptors

020477Y Adapter 37 mm

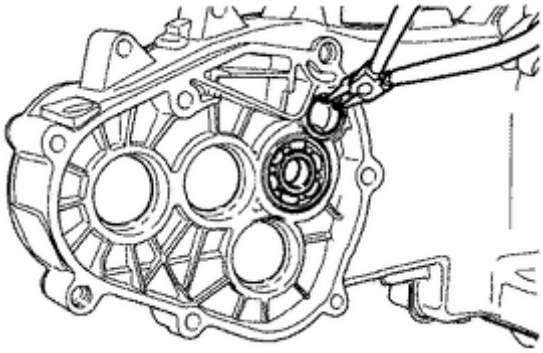
020483Y 30 mm guide

020359Y 42 x 47 mm adaptor

020489Y Hub cover support stud bolt set

Removing the driven pulley shaft bearing

- As you need to remove the driven pulley shaft, its bearing and oil guard, remove the transmission cover as described above.
- Extract the driven pulley shaft from its bearing.
- Remove the oil guard using a screwdriver, working from inside the bearing and being careful not to damage the housing, make it come out of the belt transmission side.
- Remove the Seeger ring shown in the figure Remove the driven pulley shaft bearing using the modular punch.



Specific tooling

020376Y Handle for adaptors

020375Y Adapter 28 x 30 mm

020363Y 20mm guide

Inspecting the hub shaft

- Check that the three shafts exhibit no wear or deformation on the toothed surfaces, at the bearing housings and at the oil guards.
- In case of faults, replace the damaged components.

Inspecting the hub cover

- Check that the fitting surface is not dented or distorted.
- Check the bearing bearings.
- In case of anomalies, replace the damaged components.

Refitting the wheel axle bearing

- Support the hub cover on a wooden surface.
- Heat the cover crankcase with special heat gun.
- Fit the wheel shaft bearing with a modular punch as shown in the figure.
- Fit the Seeger ring.
- Fit the oil guard with seal lip towards the inside of the hub and place it flush with the internal surface by means of the appropriate tool used from the 52 mm side.

The 52 mm side of the adapter must be turned towards the bearing.

Specific tooling

020376Y Handle for adaptors

020360Y 52 x 55 mm adaptor

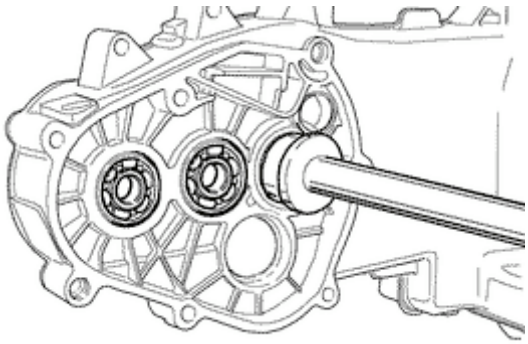
020483Y 30 mm guide

Refitting the hub cover bearings

For the fitting of the hub box bearings the engine crankcase and the cover must be heated with the special heat gun.

- The three 15 mm bearings must be fitted using the appropriate tools.

The 42 mm side of the adapter must be turned towards the bearing.



Specific tooling

020150Y Air heater support

020151Y Air heater

020376Y Handle for adaptors

020359Y 42 x 47 mm adaptor

020412Y 15 mm guide

N.B.

Use the stud bolt set in the fitting of the bearing on the cover to support said cover.

- Refit the driven pulley shaft bearing with a modular punch as shown in the figure.

N.B.

If the bearing has an asymmetrical ball retention cage, place it with the balls visible from the inside side of the hub.

Specific tooling

020376Y Handle for adaptors

020359Y 42 x 47 mm adaptor

020363Y 20mm guide

N.B.

When fitting the bearings on the engine crankcase, this should, as far as possible, be supported on a surface to allow the bearings to be driven vertically.

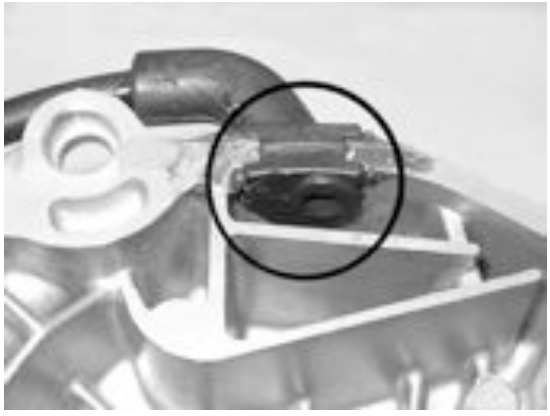
- Refit the Seeger ring with the opening facing the bearing and fit a new oil guard flush with the crankcase from the pulley side.

Refitting the hub bearings

- Install the three shafts in the engine crankcase as shown in the figure.

Refitting the ub cover

- Fit a new gasket together with the centring dowels.
- Seal the gasket of the breather pipe using black silicone sealant.
- Fit the gearbox cover, making sure the breather pipe is in the correct position.
- Position the shorter screw that can also be recognised from the different colour as shown in the figure.

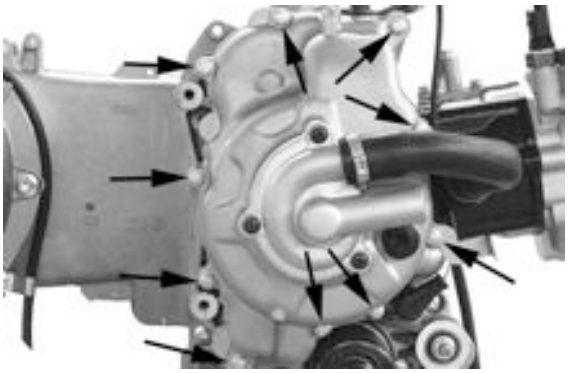


- Fix the breather tube support by means of the lower screw.
- Fit the remaining screws and tighten the seven screws to the prescribed torque.

Flywheel cover

Removing the hub cover

- Remove the clip fixing the hose to the cylinder.
- Remove the ten fixings
- Remove the flywheel cover.



Removing the stator

- Remove the two pickup screws and the screw holding the wiring support and the three stator clamping screws shown in the figure.
- Remove the stator and its wiring.

Refitting the stator

- Refit the stator and flywheel carrying out the removal procedure in reverse, tightening the studs to the prescribed torque.

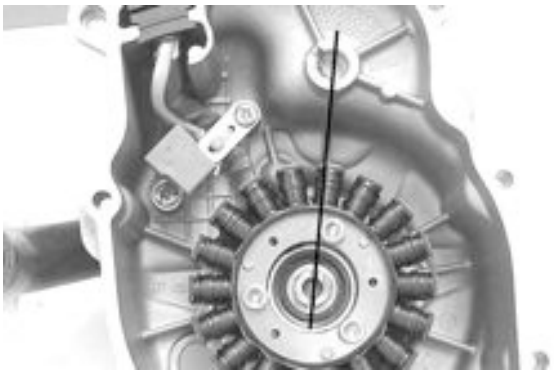
Locking torques (N*m)

Stator assembly screws (°) 3 ÷ 4

Refitting the flywheel cover

- Position the spline clip on the crankshaft and orient the end as shown in the figure.

- Orient the water pump shaft with reference to the transmission gear seat as shown in the photo.



- Refit the cover over the engine and tighten the screws to the prescribed torque.
- Carry out the steps in the reverse order from the dismantling procedure.

CAUTION

TAKE CARE TO CORRECTLY POSITION THE FLYWHEEL CONNECTOR. MAKE SURE THE CENTRING DOWELS ARE PRESENT.

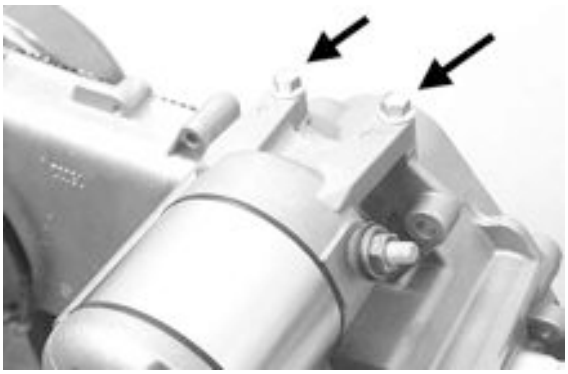
Locking torques (N*m)

Flywheel cover screws 11 - 13

Flywheel and starting

Removing the starter motor

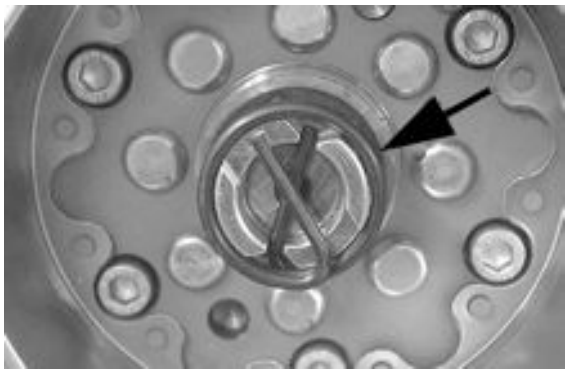
- Remove the two screws indicated in the figure.
- Take the starter motor out of its seat



Removing the flywheel magneto

- Remove the water pump shaft and crankshaft

spline clip



- Line up the two holes in the flywheel as shown in the photo

- Screw in the guide bushing that is part of the special flywheel stop tool on the flywheel as shown in the photo.

- Insert the special flywheel stop tool on the flywheel as shown in the photo

Specific tooling

020627Y Flywheel stop wrench

- Remove the plate indicated in the photo.

- Remove the flywheel nut with its washer
- Tighten the flywheel nut by three or four threads so that the flywheel does not fall accidentally on extraction
- Screw the extractor onto the flywheel and extract it as shown in the photograph

Specific tooling

020467Y Flywheel extractor

Inspecting the flywheel components

- Check the integrity of the internal plastic parts of the flywheel and the pickup control plate.

Refitting the free wheel

- Check that the freewheel contact surfaces are in good condition.
- Carefully clean the freewheel to remove any residues of LOCTITE.
- Degrease the threading of the holes on the freewheel and the fastening screws.
- Apply the recommended product to the ends of the screws.

Recommended products

Loctite 243 Medium threadbrake

Medium Loctite threadbrake 243

- Install the freewheel on the flywheel, with the rectified part in contact with the flywheel, that is with visible wheel snap ring.
- Tighten the 6 fastening screws in a crossed se-

quence to the prescribed torque.

Locking torques (N*m)

freewheel mounting screws on the flywheel 13 - 15

- Lubricate the freewheel "rollers"

Refitting the flywheel magneto

- Remove the freewheel retaining plate indicated in the photograph
- Remove the transmission gear and the free-wheel

- Insert the freewheel on the flywheel as shown in the photo
- Then refit the flywheel with freewheel and trans-mission gear

- Using the special flywheel stop tool, tighten up

the flywheel fixing nut to the prescribed torque

-Refit the retention plate

Specific tooling

020627Y Flywheel stop wrench

Locking torques (N*m)

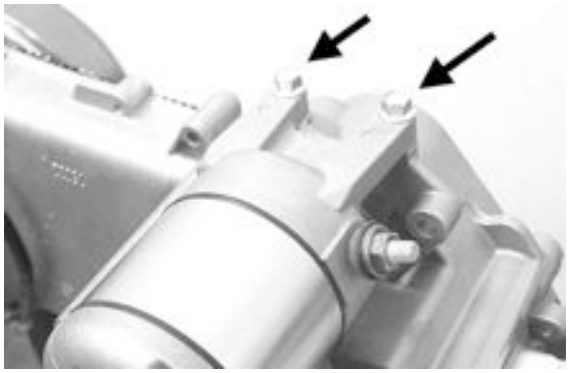
Flywheel nut 94 ÷ 102

Refitting the starter motor

- Fit a new O-ring on the starter motor and lubricate it.
- Install the starter on the engine crankcase, tightening the two screws to the prescribed torque.

Locking torques (N*m)

Starter screws 11 - 13



Cylinder assy. and timing system

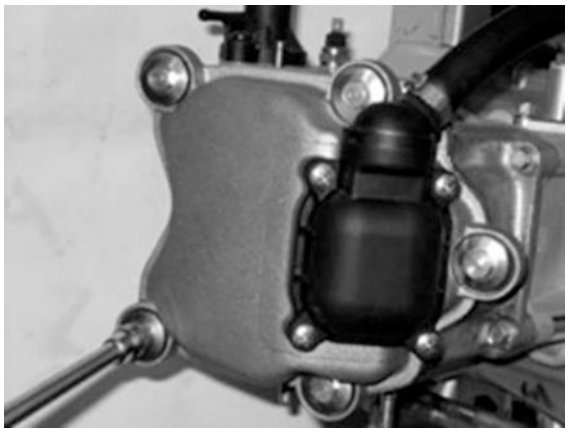
Removing the intake manifold

Loosen the three screws and remove the air intake manifold.

- When refitting, secure to the prescribed torque.

Removing the rocker-arms cover

- Remove the 5 screws indicated in the figure.



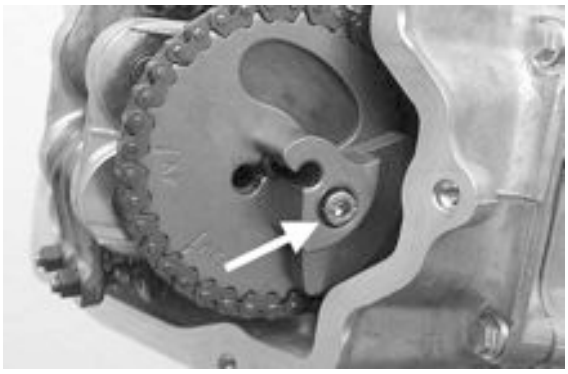
Removing the timing system drive

- Remove the parts listed below first: transmission cover, drive pulley with belt, oil sump with spring and by-pass piston, oil pump pulley cover, O-ring on the crankshaft and the sprocket wheel separation washer.
- Remove the tappet cover.
- Remove the central screw fastener and the automatic valve-lifter retaining cover, as shown in the figure.

- Remove the return spring of the automatic valve lifter assembly and the automatic valve lifter assembly and its end of stroke washer.

- Loosen the central screw on the tensioner first.
- Remove the two fixings shown in the figure.
- Remove the tensioner with its gasket.

- Remove the internal hex screw and the counter-weight shown in the figure.



- Remove the camshaft command pulley and its washer.

- Remove the command sprocket wheel and the timing chain.
- Remove the screws indicated in the figure, the spacer bar and the tensioner pad.

The chain tensioning pad must be removed from the transmission side. As regards the lower chain guide pad, it may only be removed after the head has been removed.

N.B.

IT IS ADVISABLE TO MARK THE CHAIN IN ORDER TO ENSURE THAT THE INITIAL DIRECTION OF RO-

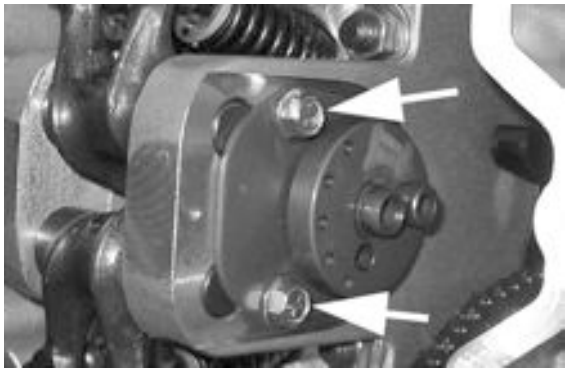
TATION IS MAINTAINED.

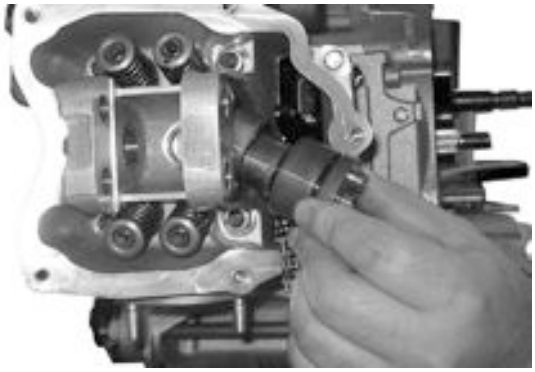
Removing the cam shaft

- Remove the two screws and the cam shaft retainer shown in the diagram.
- Remove the cam shaft.
- Remove the pins and the rocker arms from the flywheel side holes.

N.B.

IN CASE OF NEED, THE HEAD MAY BE REMOVED WITH THE CAMSHAFT, PINS, ROCKERS AND FIXING BRACKET. THE HEAD CAN ALSO BE REMOVED WITHOUT REMOVING THE CHAIN AND THE DRIVING SHAFT CHAIN TIGHTENER.





Removing the cylinder head

- Remove the spark plug.
- Remove the 2 side fixings shown in the figure.
- Loosen the 4 head-cylinder fastening nuts in two or three stages and in criss-cross fashion.
- Remove the head, the two centring dowels and the gasket.

N.B.

IN CASE OF NEED, THE HEAD MAY BE REMOVED WITH THE CAMSHAFT, PINS, ROCKERS AND FIXING BRACKET. THE HEAD CAN ALSO BE REMOVED WITHOUT REMOVING THE CHAIN AND THE DRIVING SHAFT CHAIN TIGHTENER.

Removing the valves

- Using the appropriate tool fitted with an adapter, remove the cotter pins, plates, springs and valves.
- Remove the oil guards with the appropriate tool.
- Remove the lower spring supports.

CAUTION

Replace the valves in such a way as to recognise their original position on the head.

Specific tooling

020382Y011 adapter for valve removal tool

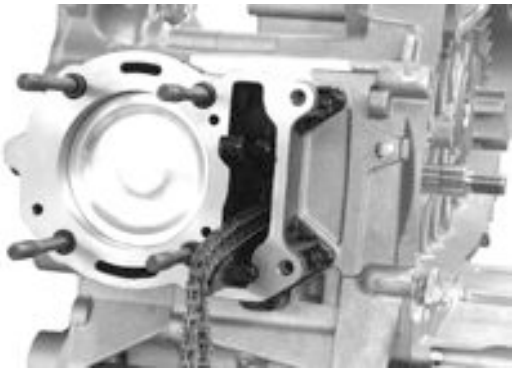
020382Y Tool for removing valve cotters equipped with part 012

020431Y Valve oil seal extractor

Removing the cylinder - piston assy.

Removing cylinder and piston

- Remove the chain guide pad.
- Remove the 4 O-rings on the stud bolts.
- Pull out the cylinder.
- Remove the cylinder base gasket.
- Remove the two stop rings, the wrist pin and the piston.



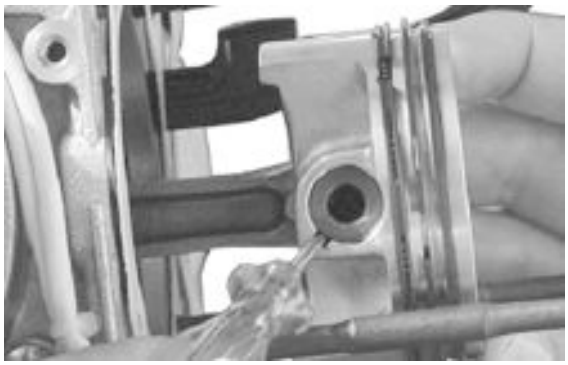
- Remove the piston seals.

CAUTION

TO AVOID DAMAGING THE PISTON, SUPPORT IT WHILE REMOVING THE CYLINDER.

N.B.

BE CAREFUL NOT TO DAMAGE THE SEALING RINGS DURING REMOVAL.

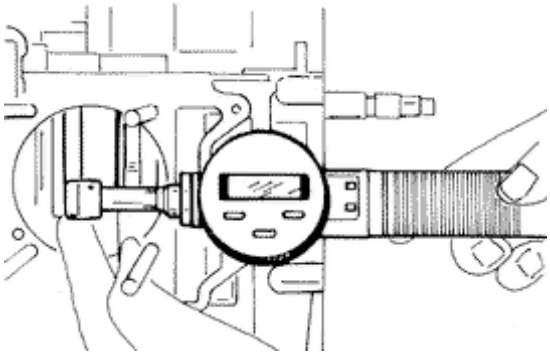


Inspecting the small end

- Measure the internal diameter of the rod small end using an internal micrometer.

N.B.

If the diameter of the rod small end exceeds the standard diameter, shows signs of wear or overheating, replace the crankshaft.



Characteristic

Checking the connecting rod small end: Maximum diameter

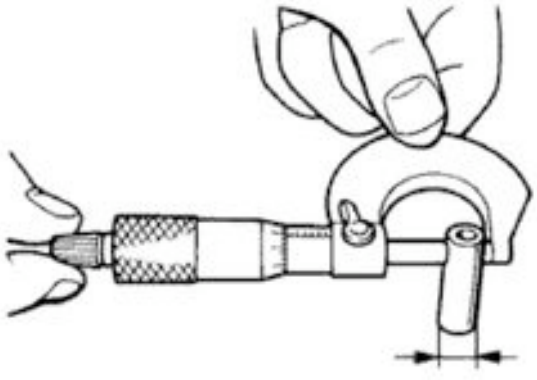
15.030 mm

Checking the connecting rod small end: Standard diameter

15 +0.015+0.025mm

Inspecting the wrist pin

- Measure the outer diameter of the gudgeon pin.
- Calculate the rod small end - gudgeon pin coupling clearance.



Characteristic

Pin diameter: Standard clearance

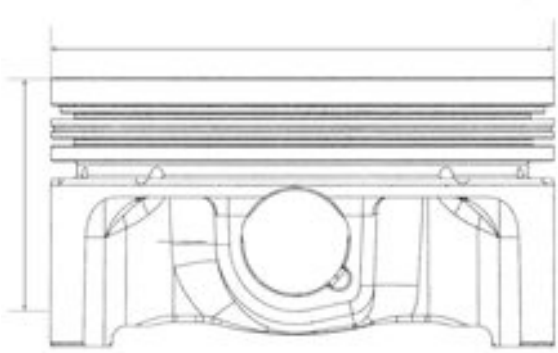
0.015 ÷ 0.029 mm

Pin diameter Standard diameter

14.996 - 15.000 mm

Inspecting the piston

- Measure the diameter of the wrist pin seat on the piston.
- Calculate the piston pin coupling clearance.
- Measure the outside diameter of the piston, perpendicular to the gudgeon pin axis.
- Take the measurement at 5 mm from the base in the position shown in the figure.
- Carefully clean the seal housings.
- Measure the coupling clearance between the seal rings and the grooves using suitable sensors, as shown in the diagram.
- If the clearances exceed the limits specified in the table below, the piston should be replaced by a new one.



N.B.

MEASURE THE CLEARANCE BY INSERTING THE BLADE OF THE THICKNESS GAUGE FROM THE SIDE OF THE 2ND PISTON RING.

N.B.

THE PIN HOUSINGS HAVE TWO LUBRICATION CHANNELS. FOR THIS REASON MEASUREMENT OF THE DIAMETER MUST BE CARRIED OUT ACCORDING TO THE AXIS OF THE PISTON.

Characteristic

Wrist pin seat on the piston: Standard diameter

15.001 ÷ 15.006 mm

Diameter of the wrist pin seat on the piston: Standard clearance

0.001 ÷ 0.010 mm

piston diameter

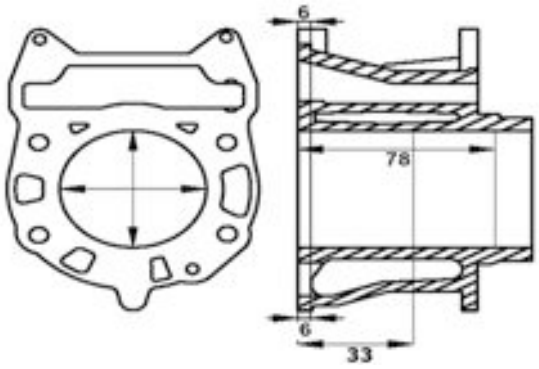
71.953 - 71.981 mm

Fitting clearance

Top piston ring - standard coupling clearance 0.015 - 0.06 mm **Top piston ring - maximum clearance allowed after use** 0.07 mm **Middle**

piston ring - standard coupling clearance 0.015 - 0.06 mm **Middle piston ring - maximum clearance allowed after use** 0.07 mm **scraper ring- standard coupling clearance** 0.015 - 0.06 mm **scraper ring - maximum clearance allowed after use** 0.07 mm

Inspecting the cylinder



- Using a bore meter, measure the inner cylinder diameter at three different points according to the directions shown in the figure.
- Check that the head coupling surface is not worn or misshapen.
- Pistons and cylinders are classified according to diameter. The coupling must be made with those of the same type (M-M, N-N, O-O, P-P).

Characteristic

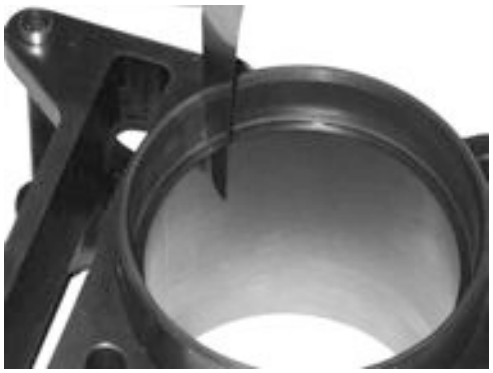
cylinder: standard diameter

71.990 - 72.018 mm (at 33 mm)

Maximum allowable runout:

0.05 mm

Inspecting the piston rings



Sealing rings

- Alternately insert the three sealing rings into the cylinder, in the area where it retains its original diameter. Using the piston, insert the rings perpendicularly to the cylinder axis.
- Measure the opening (see figure) of the sealing rings using a feeler gauge.
- If any measurements are greater than specified, replace the piston rings.

N.B.

BEFORE REPLACING ONLY THE PISTON RINGS, ENSURE THAT THE CLEARANCE BETWEEN THE PISTON RINGS AND THE PISTON RING GROOVES,

AND BETWEEN THE PISTON AND THE CYLINDER, IS AS SPECIFIED. IN ANY CASE, NEW PISTON RINGS USED IN COMBINATION WITH A USED CYLINDER MAY HAVE DIFFERENT BEDDING CONDITIONS THAN THE STANDARD.

Characteristic

Top piston ring

Standard opening: 0.15 ÷ 0.30 mm

Middle piston ring

Standard opening: 0.20 ÷ 0.40 mm

scraper ring

Standard opening: 0.20 ÷ 0.40 mm

Removing the piston

- Install piston and wrist pin onto the connecting rod, aligning the piston arrow the arrow facing towards the exhaust.
- Fit the wrist pin stop ring onto the appropriate tool
- With opening in the position indicated on the tool

S = left

D = right

- Place the wrist pin stop ring into position using a punch
- Fit the wrist pin stop using the plug as shown in the figure

N.B.

THE TOOL FOR INSTALLING THE LOCKING RINGS MUST BE USED MANUALLY.

CAUTION

USING A HAMMER MAY DAMAGE THE LOCK HOUSINGS

Specific tooling

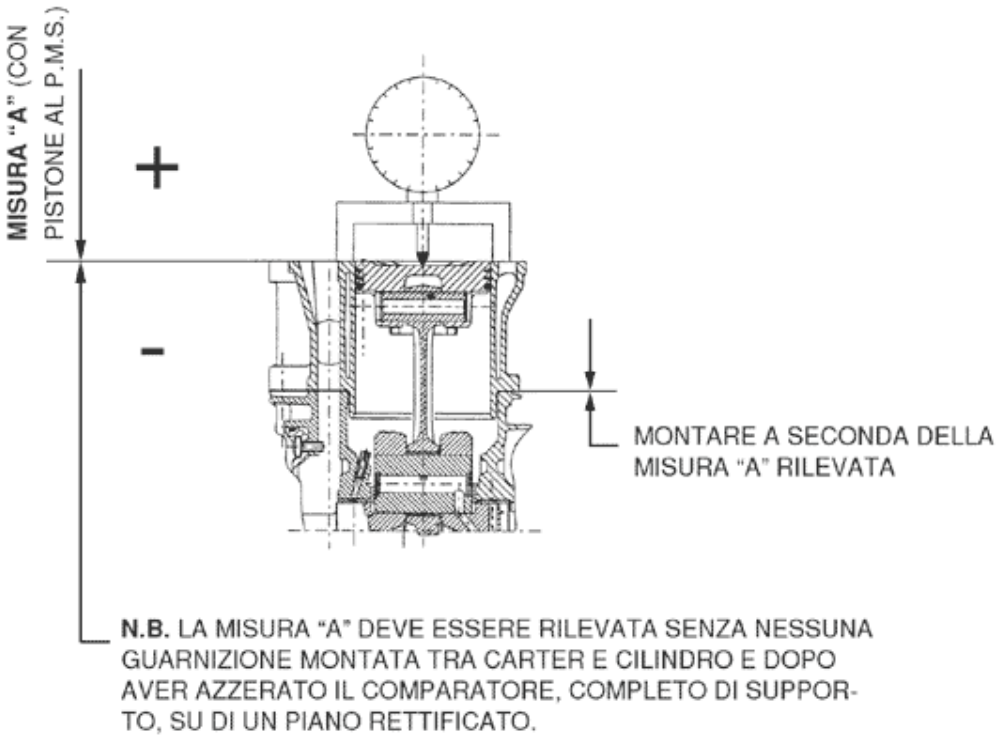
020454Y Tool for fitting piston pin stops (200 - 250)

Choosing the gasket

Characteristic

Compression ratio 250 version

CR: 10.5 ÷ 11.5 : 1


MISURA "A" (CON PISTONE AL P.M.S.)
+
-
MONTARE A SECONDA DELLA MISURA "A" RILEVATA
N.B. LA MISURA "A" DEVE ESSERE RILEVATA SENZA NESSUNA GUARNIZIONE MONTATA TRA CARTER E CILINDRO E DOPO AVER AZZERATO IL COMPARATORE, COMPLETO DI SUPPORTO, SU DI UN PIANO RETTIFICATO.

N.B.

MEASUREMENT "A" TO BE TAKEN IS A VALUE OF PISTON RE-ENTRY, IT INDICATES BY HOW MUCH THE PLANE FORMED BY THE PISTON CROWN FALLS BELOW THE PLANE FORMED BY THE TOP OF THE CYLINDER. THE FURTHER THE PISTON FALLS INSIDE THE CYLINDER, THE LESS THE BASE GASKET IS TO BE APPLIED (TO RECOVER THE COMPRESSION RATIO) AND VICEVERSA.

ENGINE 250 SHIMMING

Name	Measure A	Thickness
Shimming	3.70 - 3.60	0.4 ± 0.05
Shimming	3.60 - 3.40	0.6 ± 0.05
Shimming	3.40 - 3.30	0.8 ± 0.05

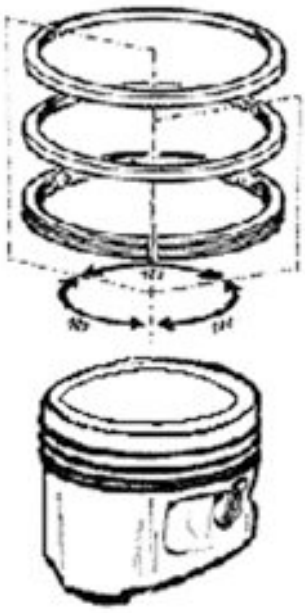
Refitting the piston rings

Fitting the sealing rings

- Place the oil scraper spring on the piston.
- Re-fit the oil scraper ring with the join of spring

ends on the opposite side from the ring gap and the word 'TOP' towards the crown of the piston. The chamfered side of the oil scraper ring should always be facing the piston crown.

- Fit the middle piston ring with the identification letter facing the crown of the piston. The tapered side of the middle piston ring should always be facing away from the crown of the piston.
- Fit the top piston ring with the word 'TOP' or the reference mark facing the crown of the piston.
- Offset the piston ring gaps on the three rings by 120° to each other as shown in the figure.
- Lubricate the components with engine oil.
- The top piston ring on the 250 engine has an L cross section.

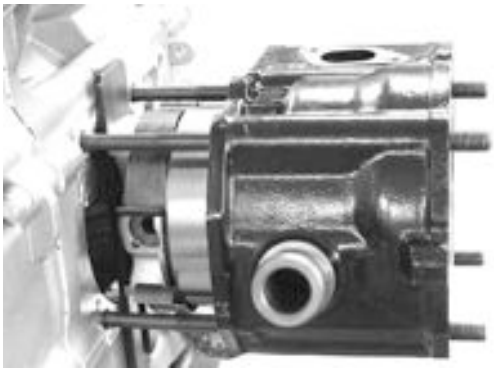


N.B.

THE 2 SEALING LININGS HAVE A CONICAL SURFACE OF CONTACT WITH THE CYLINDER. THIS IS TO ENSURE A BETTER ADAPTATION.

Refitting the cylinder

- Fit the base gasket of the chosen thickness, previously determined.
- Using the fork support and the piston ring retaining band, refit the cylinder as shown in the figure.



N.B.

BEFORE FITTING THE CYLINDER, CAREFULLY BLOW OUT THE LUBRICATION DUCT AND OIL THE CYLINDER BARREL.

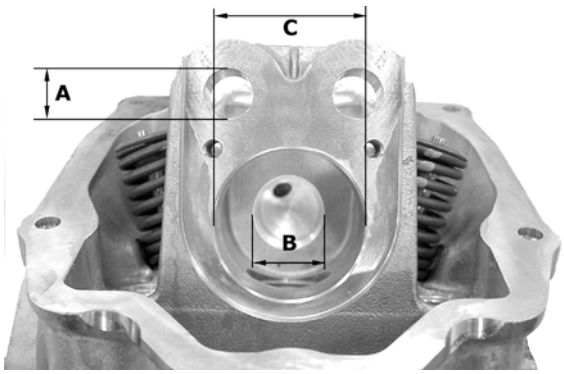
Specific tooling

020426Y Piston fitting fork

020393Y Piston assembly band

Inspecting the cylinder head

- Using a trued bar and feeler gauge check that the cylinder head surface is not worn or distorted. Maximum allowable runout: 0.05 mm
- Ensure that the camshaft and rocker arm pivot bearings show no signs of wear.
- Check that the cylinder head cover surface, the intake manifold and the exhaust manifold are not worn.



Characteristic

capacity "A"

Diameter 12.000 - 12.018 mm

capacity "B"

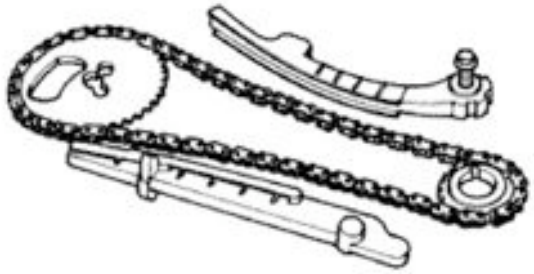
Diameter 20.000 - 20.021 mm

capacity "C"

Diameter 37.000 - 37.025 mm

Inspecting the timing system components

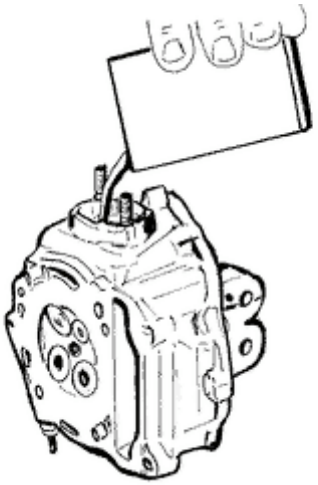
- Check that the guide shoe and the tensioner shoe are not worn out.
- Ensure that the camshaft drive pulley, the chain assembly and the sprocket wheel are not worn.
- If you encounter wear, replace the parts or, if the chain, sprocket wheel and pulley are worn replace the whole assembly.
- Remove the centre screw with the washer and the tensioner spring. Check that the one-way mechanism is not worn.
- Check the condition of the tensioner spring.
- If examples of wear are found, replace the



whole assembly.

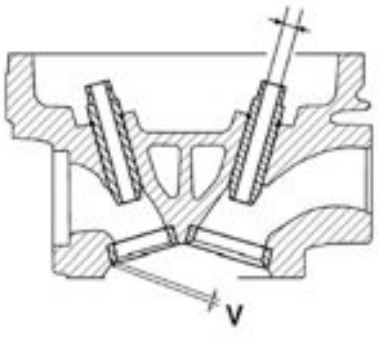
Inspecting the valve sealings

- Insert the valves into the cylinder head.
- Alternatively check the intake and exhaust valves.
- The test is carried out by filling the manifold with petrol and checking that the head does not ooze through the valves when these are just pressed with the fingers.



Inspecting the valve housings

- Check the width of the imprint on the valve seat"**V**" wear limit max. 1.6 mm.
- Remove any carbon formation from the valve guides.
- Measure the inside diameter of each valve guide.
- Take the measurement at three different heights in the rocker arm push direction.
- If the width of the impression on the valve seat or the diameter of the valve guide exceed the specified limits, replace the cylinder head.



Characteristic

Valve seat wear Intake guide

limit accepted: 5.022

Valve seat wear Intake guide

Standard diameter 5.000 ÷ 5.012 mm

Valve seat wear Exhaust guide

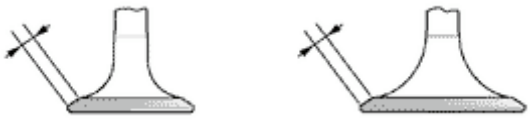
Accepted limit 5.022

Valve seat wear Exhaust guide

Standard diameter 5.000 ÷ 5.012 mm

Inspecting the valves

- Measure the width of the sealing surface on the valve seats and on the valves.
Sealing surface width: After use: Intake and exhaust: 1.6 mm
- If any of the sealing surfaces on the valves is wider than the specified limit or is damaged in one or more points, or curved, replace the valve with a new one.



CAUTION

DO NOT CONFUSE THE INSTALLATION POSITIONS OF THE VALVES (LEFT - RIGHT).

Characteristic

Valve wear check Standard: Intake and exhaust:

0.99 - 1.27 mm

- Measure the diameter of the valve stems in the three positions indicated in the diagram.
- Calculate the clearance between valve stem and valve guide.
- Check that there are no signs of wear on the surface of contact with the articulated register terminal.
- If no anomalies are found during the above checks, the same valves can be reused. For best sealing results, it is advisable to grind the valves. Grind the valves gently with a fine-grained lapping compound. During the grinding, keep the cylinder head with the valve axes in a horizontal position. This will prevent the lapping compound residues from penetrating between the valve stem and the guide (see figure).

CAUTION

TO AVOID SCORING THE CONTACT SURFACE, DO NOT KEEP ROTATING THE VALVE WHEN NO LAPPING COMPOUND IS LEFT. CAREFULLY WASH THE CYLINDER HEAD AND THE VALVES WITH A SUITABLE PRODUCT FOR THE TYPE OF LAPPING COMPOUND BEING USED.

N.B.

DO NOT CHANGE THE POSITIONS THE VALVES ARE FITTED IN

Characteristic

Valve check Standard length

Exhaust: 94.4 mm

Valve check Standard length

Intake: 94.6 mm

Valve check Maximum admissible clearance

Exhaust: 0.072 mm

Valve check Maximum admissible clearance

Intake: 0.062 mm

Valve check standard clearance

Exhaust: 0.025 ÷ 0.052 mm

Valve check standard clearance

Intake: 0.013 ÷ 0.040 mm

Valve check Minimum admissible diameter

Exhaust: 4.95 mm

Valve check Minimum admissible diameter

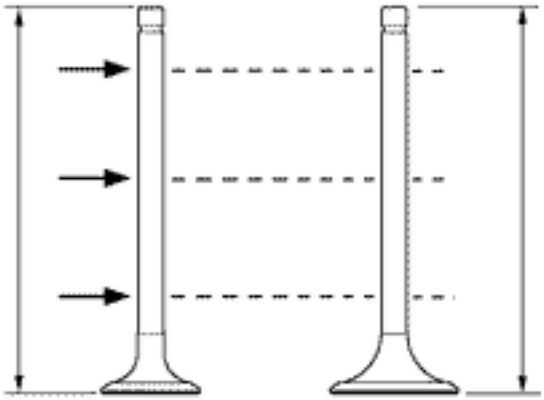
Intake: 4.96 mm

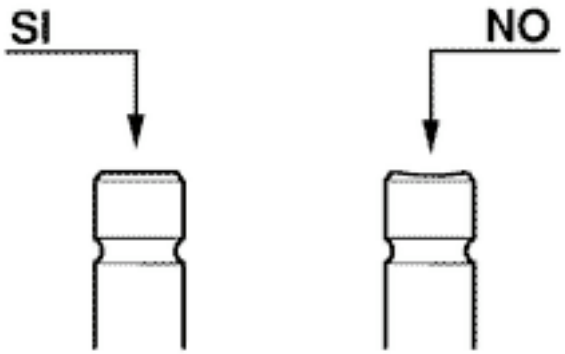
Valve check Standard diameter

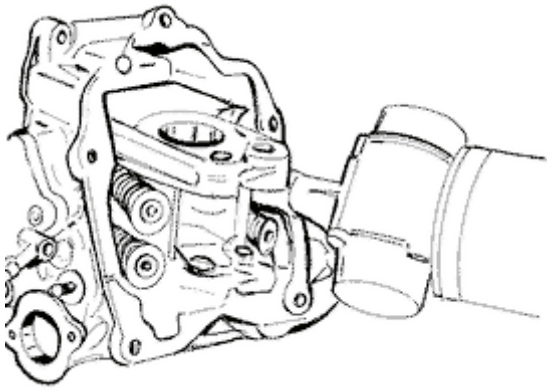
Intake: 4.972 ÷ 4.987 mm

Valve check Standard diameter

Exhaust: 4.96 ÷ 4.975 mm

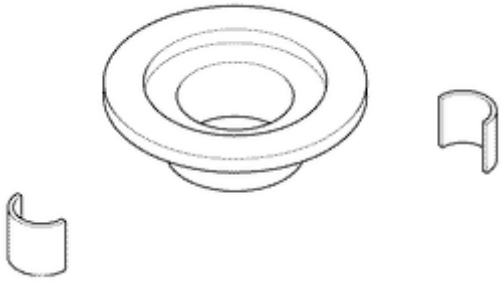






Inspecting the springs and half-cones

- Check that the upper spring caps and the cotter halves show no signs of abnormal wear.



Refitting the valves

- Lubricate the valve guides with engine oil.
- Place the valve spring supports on the head.
- Using the special punch, fit the four valve seals.
- Fit the valves, the springs and the spring retaining caps. Using the appropriate tool with adapter, compress the springs and insert the split cones in their seats.

N.B.

DO NOT CHANGE THE VALVE ASSEMBLY POSITION. FIT THE VALVES WITH THE REFERENCE COLOUR ON THE HALF-CONES SIDE (LARGER STEP CURLS).

Specific tooling

020306Y Punch for fitting valve sealing ring

020382Y Tool for removing valve cotters equipped with part 012

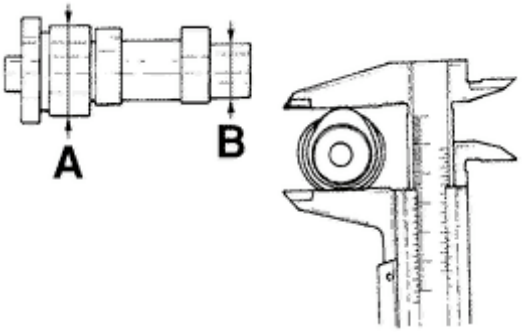
020382Y011 adapter for valve removal tool

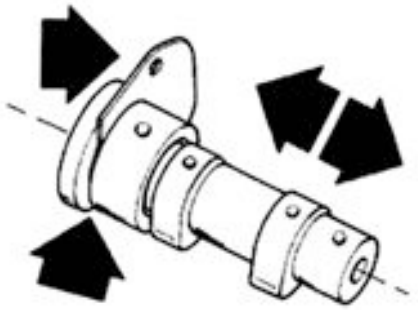
Inspecting the cam shaft

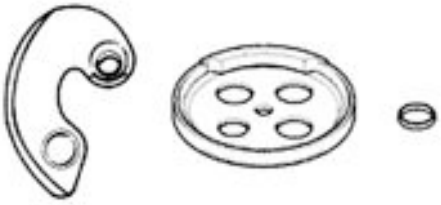
- Inspect the cam shaft for signs of abnormal wear on the cams.
- Check the cam height.
- Check there is no wear on the cam shaft retaining plate and its associated groove on the cam shaft.

- If any of the above dimensions are outside the specified limits, or there are signs of excessive wear, replace the defective components with new ones.
- Check there are no signs of wear on the automatic valve-lifter cam, or the end-of stroke roller, or the rubber buffer on the automatic valve-lifter retaining cover.
- Check the automatic valve-lifter return spring is not deformed by over-stretching.
- Replace any defective or worn components.
- Check the rocker pins do not show signs of wear or scoring.
- Measure the internal diameter of each rocker arm.

Check there are no signs of wear on the pad from contact with the cam and on the jointed adjustment plate .







Characteristic

Internal rocker arm diameter: Standard diameter

Diameter 12.000 - 12.011 mm

Rocker arm pin diameter: Standard diameter

Diameter 11.977 - 11.985 mm

Cam shaft check: Maximum admissible axial clearance

0.42 mm

Cam shaft check: Standard axial clearance:

0.11 - 0.41 mm

Cam shaft check: Standard height

Exhaust: 29.209 mm

Cam shaft check: Standard height

Intake: 30.285 mm

Cam shaft check: Minimum admissible diameter

Bearing B diameter: 19.950 mm

Cam shaft check: Minimum admissible diameter

Bearing A diameter: 36.94 mm

Cam shaft check: Standard diameter

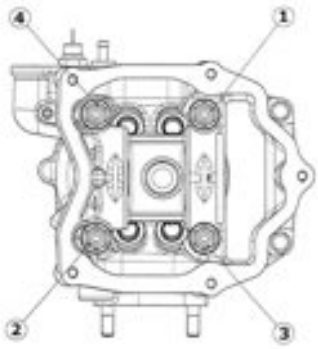
Bearing B diameter: 19.959 ÷ 19.98 mm

Cam shaft check: Standard diameter

Bearing A diameter: 36.95 ÷ 36.975 mm

Refitting the head and timing system components

- Fit the timing chain guide pad.
- Insert the centring dowel between the cylinder head to the cylinder, fit the cylinder head gasket and the cylinder head.
- Lubricate the stud bolt threading.
- Tighten up the nuts to an initial pre-torque of 7±1 N·m
- Tighten up the nuts to a second pre-torque of 10±1 N·m
- Rotate by an angle of 270°
- To carry out the operations described above, follow the tightening sequence in the figure.
- Fit the two screws on the outside of the timing chain side and tighten them to the prescribed torque.



N.B.

BEFORE INSTALLING THE HEAD, MAKE SURE THAT THE LUBRICATION CHANNEL IS CLEAN USING A COMPRESSED AIR JET.

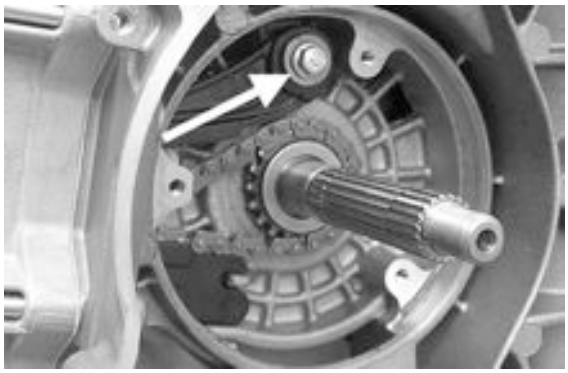
Locking torques (N*m)

Timing chain tightener support screw 11 ÷ 13

- Refit the lower timing chain sprocket wheel on the crankshaft, with the chamfer facing the inser-

tion side.

- Loop the timing chain around the sprocket on the crankshaft.
- Fit the chain tensioner pad from the cylinder head side.
- Fit the spacer and the screw fastener.
- Tighten the screws to the prescribed torque.
- Fit the pins and rocker arms.
- Lubricate the two rocker arms through the holes at the top.
- Lubricate the bearings and insert the cam shaft in the cylinder head with the cams corresponding to the rockers.
- Insert the retention plate and tighten the two screws shown in the picture to the prescribed torque.
- Refit the spacer on the cam shaft.
- Rotate the engine so that the piston is at top dead centre, using the reference marks on the flywheel and the crankcase.
- Holding this position insert the chain on the camshaft control pulley.
- Insert the pulley on the cam shaft while keeping the reference **4V** in correspondence with the reference mark on the head.
- Fit the counterweight and tighten the clamping screw to the prescribed torque.
-Fit the end-stop ring on the automatic valve-lifter cam and fit the automatic valve-lifter cam to the cam shaft.
- Fit the automatic valve-lifter return spring.
- During this operation the spring must be loaded by approximately 180°.
- Fit the automatic valve-lifter retaining dish, using the counterweight screw fastener as a reference.

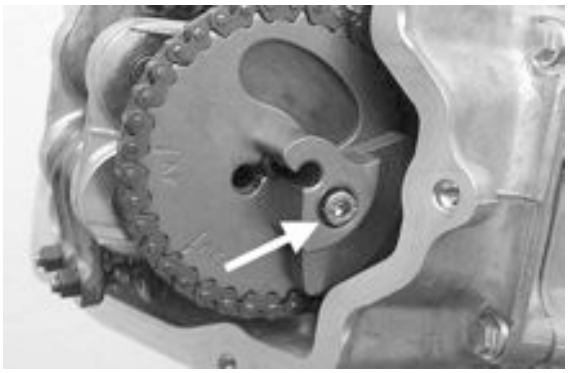


- Tighten the clamping screw to the prescribed torque.
- Set the tensioner cursor in the rest position.
- Fit the chain tensioner on the cylinder, using a new gasket, and tight the two screws to the prescribed torque.
- Insert the chain tensioning screw, together with the spring and washer, tightening it to the prescribed torque.
- Adjust the valve clearance.
- Fit the spark plug.

Electrode distance 0.8 mm

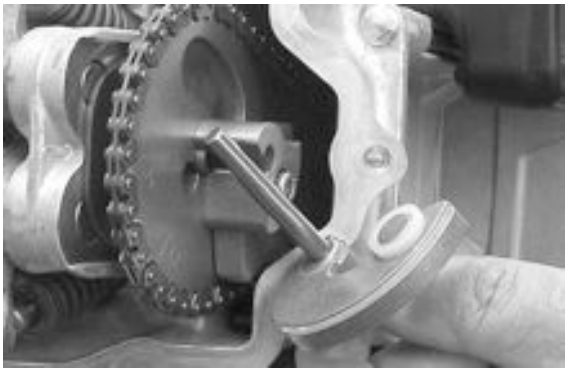
N.B.

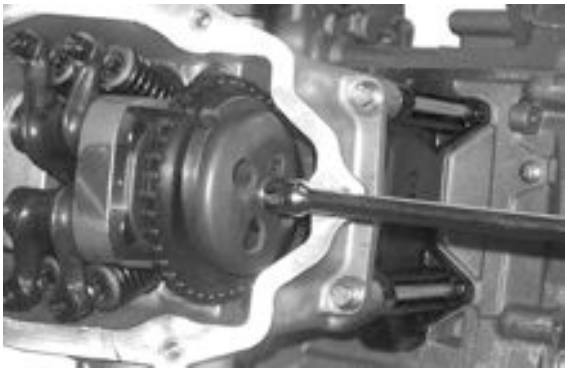
GREASE THE END STOP RING TO PREVENT IT COMING OUT AND FALLING INTO THE ENGINE.



Locking torques (N*m)

Timing chain tightener support screw 11 ÷ 13
Spark plug 12 - 14 Starter ground screw 7 ÷ 8.5 Timing chain tensioner pad screw 10 ÷ 14
Start up counterweight support screw 11 ÷ 15
Timing chain tensioner central screw 5 ÷ 6
Camshaft retention plate screw 4 ÷ 6



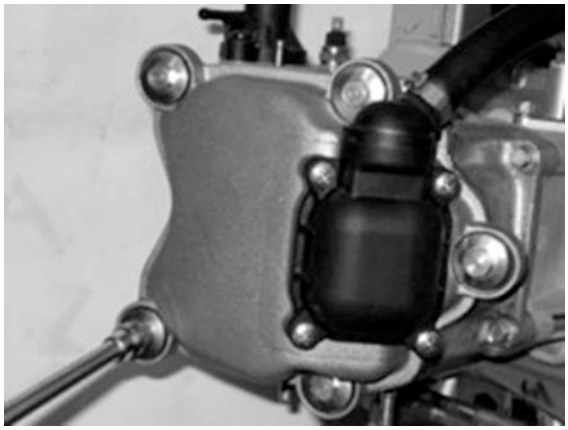


Refitting the rocker-arms cover

- Refit the cylinder head cover, tightening the 5 clamping screws to the prescribed torque.
- Make sure the gasket is positioned properly.

Locking torques (N*m)

Tappet cover screws 6 - 7 Nm



Refitting the intake manifold

Fit the intake manifold and do up the three screws.

Locking torques (N*m)

Inlet manifold screws 11 ÷ 13

Crankcase - crankshaft

Splitting the crankcase halves

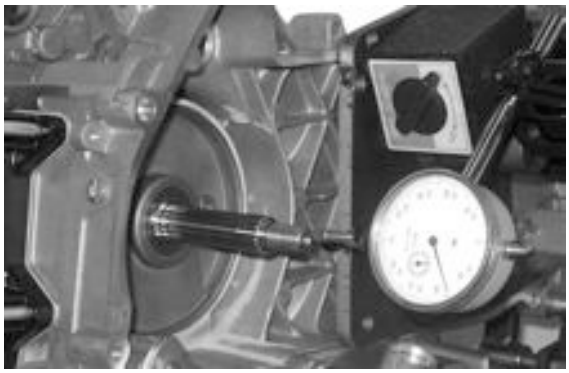
- Before opening the crankcase, it is advisable to check the axial clearance of the crankshaft. To do

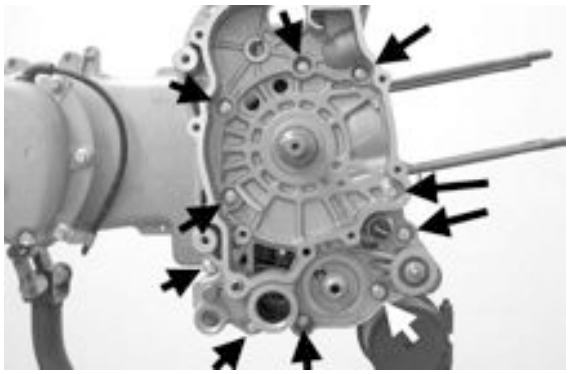
this, use a plate and a support with appropriate tool dial gauge.

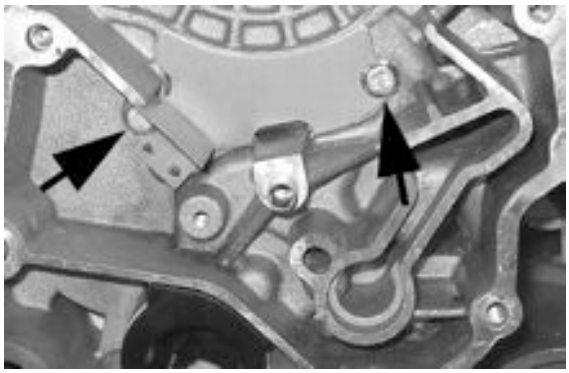
- Upper clearances are an indication of wear on the surfaces of the crankshaft casing support.
- Remove the ten crankshaft coupling screws.
- Separate the crankcase while keeping the crankshaft in one of the two halves of the crankcase.
- Remove the crankshaft .
- Remove the half crankcase coupling gasket.
- Remove the two screws and the internal cover shown in the diagram.
- Remove the oil guard on the flywheel side.
- Remove the oil filter fitting shown in the diagram.
- Check the axial clearance on the connecting rod.
- Check the radial clearance on the connecting rod.

-Check the surfaces that limit the axial free-play are not scored and measure the width of the crankshaft between these surfaces, as shown in the diagram.

- If the axial clearance between crankshaft and crankcase is exceeding and the crankshaft does not have any defect, the problem must be due to either excessive wear or wrong machining on the crankcase.
- Check the diameters of both the bearings of the crankshaft in accordance with the axes and surfaces shown in the figure. The half-shafts are classified in two categories Cat. 1 and Cat. 2 as shown the chart below.







CAUTION

THE CRANKSHAFT CAN BE REUSED WHEN THE WIDTH IS WITHIN THE STANDARD VALUES AND

THE SURFACES SHOW NO SIGNS OF SCORING.

CAUTION

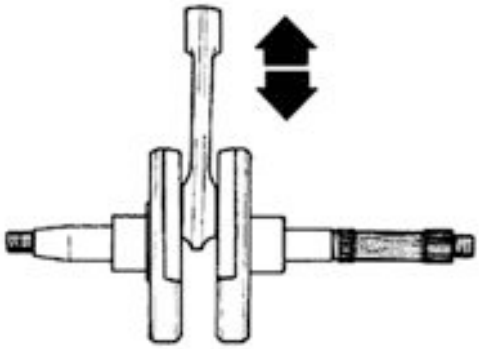
WHILE OPENING THE CRANKCASES AND REMOVING THE DRIVING SHAFT, CHECK THAT THE THREADED SHAFT ENDS DO NOT INTERFERE WITH THE MAIN BUSHINGS. FAILURE TO OBSERVE THIS PRECAUTION CAN DAMAGE THE MAIN BUSHINGS.

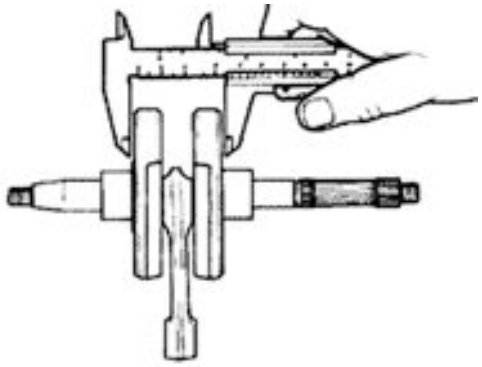
CAUTION

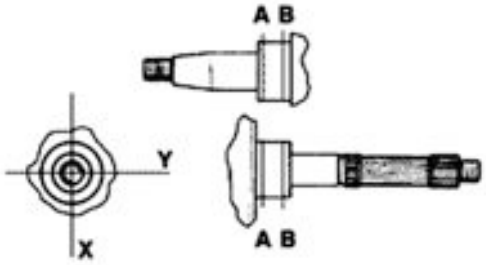
KEEP THE CRANKSHAFT IN ONE OF THE TWO HALVES OF THE CRANKCASE WHEN SEPARATING IT. IF YOU FAIL TO DO THIS, THE CRANKSHAFT MIGHT ACCIDENTALLY FALL.

N.B.

WHEN MEASURING THE WIDTH OF THE CRANKSHAFT, MAKE SURE THAT THE MEASUREMENTS ARE NOT MODIFIED BY THE RADIUSES OF FITTINGS WITH THE CRANKSHAFT BEARINGS.







Specific tooling

020262Y Crankcase splitting strip

020335Y Magnetic support for gauge

Characteristic

Axial crankshaft/crankcase clearance: Standard clearance

0.15 - 0.40 mm (when cold)

Axial connecting rod - crankshaft clearance Standard clearance

0.20 ÷ 0.50 mm

Radial connecting rod - crankshaft clearance Standard clearance

0.036 ÷ 0.054 mm

Width of crankshaft with integral washers: standard measurements

55.67 ÷ 55.85 mm

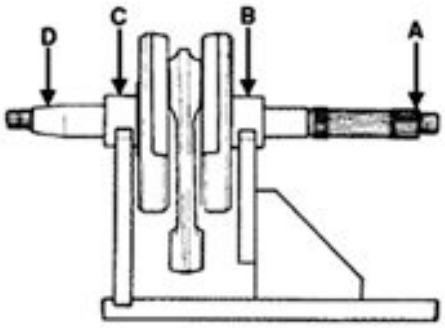
Crankshaft bearings: Standard diameter Cat. 1

28.994 ÷ 29.000

Crankshaft bearings: Standard diameter Cat. 2

29.000 ÷ 29.006

Inspecting the crankshaft alignment



To install the drive shaft on the support and to measure the misalignment in the 4 points indicated in figure.

- Check that the driving shaft cone, the tab seat, the oil seal capacity, the toothed gear and the threaded tangs are in good working order.
- In case of failures, replace the driving shaft.

The connecting rod head bushings cannot be replaced.

For the same reason, the connecting rod may not be replaced and, when cleaning the crankshaft, be very careful that no impurities get in through the shaft's lubrication holes.

In order to prevent damaging the connecting rod bushings, do not attempt cleaning the lubrication duct with compressed air.

- Make sure that the 2 pads on the crank button are properly mounted.
- A wrong installation of a buffer can seriously affect the bushing lubrication pressure.

N.B.

THE MAIN BEARINGS ARE NOT GRINDABLE

Specific tooling

020074Y Support base for alignment control of crankshaft

Characteristic

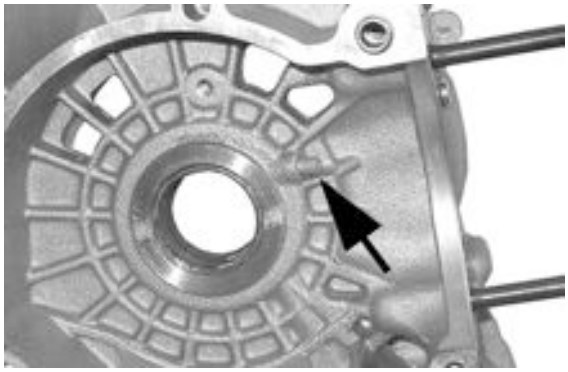
Off-line maximum admitted

A = 0.15 mm

B = 0.01 mm
C = 0.01 mm
D = 0.10 mm

Inspecting the crankcase halves

- Before proceeding to check the crankcase halves, thoroughly clean the all surfaces and oil ducts.
- On the transmission side crankcase half, take particular care cleaning the housing and oil ducts for the following components: the oil pump, the oil by-pass valve, the main bushings and the cooling jet on the transmission side (see diagram).
- Take particular care, also, that there are no signs wear oil by-pass valve housing (see Chapter Lubrication), as this could prevent a good seal in the valve, which regulates the oil pressure.
- On the flywheel side crankcase half, take particular care cleaning the oil ducts for the main bushings, the oil duct for the jet that lubricates the cylinder head and the oil drainage duct at the flywheel side oil seal.
- Inspect the mating surfaces on the crankcase halves for scratches or deformation, taking particular with the surfaces that mate with the cylinder and the mating surfaces between the crankcase halves.
- Defects in the crankcase coupling gasket between the crankcase halves or the mating surfaces shown in the diagram, could cause a drop in the oil pressure lubricating the main bearings and connection rod.
- Check the main bearing seats that limit axial clearance in the crankshaft show no signs of wear. The dimension between these seats is measured by way of the procedure described previously for measuring the crankshaft axial clearance and dimensions.



N.B.

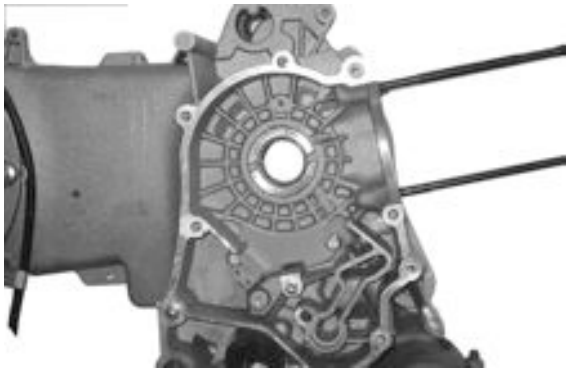
THE JET IS FED THROUGH THE MAIN BUSHINGS.

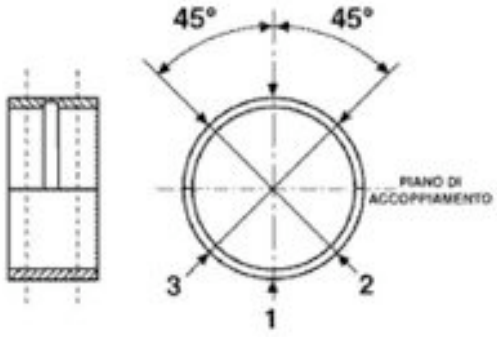
PROPER OPERATION OF THIS COMPONENT IMPROVES THE PISTON TOP COOLING. CLOGGING HAS EFFECTS THAT ARE DIFFICULT TO DETECT (PISTON TEMPERATURE INCREASE). FAILURE OR LEAK CAN CONSIDERABLY DECREASE THE MAIN BUSHING AND CONNECTING ROD LUBRICATION PRESSURE.

N.B.

THE HEAD LUBRICATION CHANNEL IS PROVIDED WITH A SHUTTER JET; THIS GIVES A "LOW PRESSURE" HEAD LUBRICATION; THIS CHOICE WAS MADE TO REDUCE THE OIL TEMPERATURE IN THE SUMP. THE JET CLOGGING IMPAIRS THE HEAD LUBRICATION AND THE TIMING MECHANISMS. A JET FAILURE CAUSES A DECREASE OF THE MAIN BUSHING AND CONNECTING ROD LUBRICATION PRESSURE.

Inspecting the crankshaft plain bearings





- To obtain a proper lubrication of the brasses, it is necessary to have an optimum lubrication pressure (3,2 bar) and a good oil rate; to this purpose, the brasses must be placed properly, so as to not have shuttering in the oil feeding channels.
- Bench brasses are realised with 2 half-bearings, one of which is solid while the other has holes and seats for lubrication.
- The solid half-bearing is intended to stand the thrusts caused by combustion, and for this reason it is arranged opposed the cylinder.
- To prevent shutters in the oil feeding channels, the matching surface of the two half-bearings must be perfectly orthogonal to the cylinder axis, as shown in the figure.
- The oil feeding channel section is also affected by the brass driving depth relative to the driving shaft axial clearance containment plane.
- Check the brass diameter in the 3 directions shown in the figure.

- Repeat the measurements for the other half of the brass. See figure.
- The crankcase is supplied in three setup versions: with RED brasses, with BLUE brasses and with YELLOW brasses.
- The brass housing hole is in the only category reported below.
- The standard brass diameter after driving is variable on the basis of a coupling selection.
- The brass seats into the crankcases are classified into 2 categories as for the driving shaft Cat. 1 and Cat. 2.
- Brasses are divided into 3 categories according to their thickness. See the table below:

TYPE	IDENTIFICATION
A	RED
B	BLUE
C	YELLOW

	Type "A" - RED	Type "B" - BLUE	Tipo "C" - YELLOW
Bench half-bearing	1,970 ÷ 1,973	1,9703 ÷ 1,976	1,976 ÷ 1,979

Brass category	Half-crankcase category	Brass inside diameter after reassembly	Possibility of assembly
A	1	29,025 ÷ 29,040	**Original**
B	1	29,019 ÷ 29,034	**Original and spare**
	2	29,028 ÷ 29,043	
C	2	29,022 ÷ 29,037	**Original**

Match the shaft with two category 1 shoulders

with category 1 crankcase (or cat. 2 with cat. 2).A spare crankcase cannot be combined with a driving shaft with mixed categories. Spare shafts have half-shafts of the same category.

Half-crankcase	Engine half-shaft	Brass
Cat.1	Cat.1	B
Cat.2	Cat.2	B
Cat.1	Cat.2	A
Cat.2	Cat.1	C

N.B.

TO KEEP THIS POSITION OF THE BUSHINGS ON THE CRANKCASE, FITTING IS FORCED ON STEEL RINGS INSERTED IN THE CASTING OF BOTH HALF-CRANKCASES.

N.B.

DO NOT TAKE THE MEASUREMENT ON THE TWO HALF-SHELL COUPLING SURFACE SINCE THE ENDS ARE RELIEVED TO ALLOW BENDING DURING THE DRIVING OPERATION.

N.B.

CRANKCASES FOR REPLACEMENTS ARE SELECTED WITH HALF-CRANKCASES OF THE SAME CATEGORY AND ARE FITTED WITH CATEGORY B BUSHINGS (BLUE)

Characteristic

Standard driving depth

1.35 ÷ 1.6

Diameter of crankcase without bushing

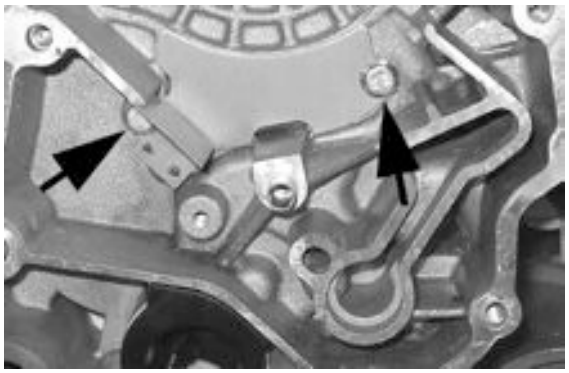
32.953 ÷ 32.963

Refitting the crankcase halves

- Fit the internal bulkhead by locking the two screws to the prescribed torque.
- Fit the oil filter fitting and tighten it to the pre-

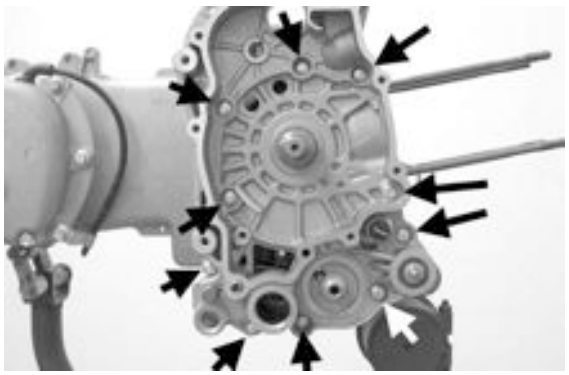
scribed torque.

- Position the oil pre-filter element as shown in the photograph.
- Place a new gasket on one of the crankcase halves, preferably on the transmission side, together with the locating dowels.
- Lubricate the main bushings and insert the crankshaft in the transmission side crankcase half.
- Reassemble the two crankcase halves.
- Fit the 10 screws and tighten them to the prescribed torque.
- Fit a new O-ring on the pre-filter and lubricate it.
- Insert the filter on the engine with the relative cap. Tighten to the prescribed torque.



Locking torques (N*m)

Internal engine crankcase bulkhead (transmission-side half shaft) screws 4 ÷ 6 Engine crankcase coupling screws 11 - 13 Oil filter on the crankcase fitting 27 ÷ 33 Engine oil drainage tap/gauze filter 24 ÷ 30



Studs

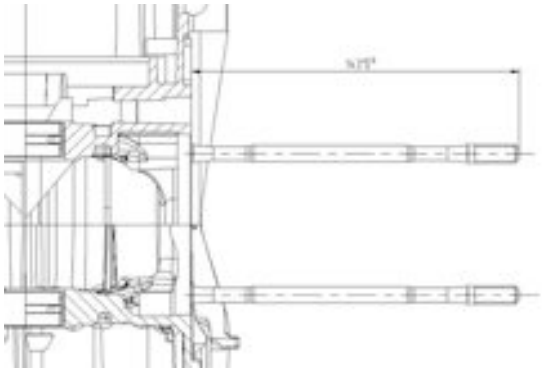
Check that the stud bolts have not worked loose from their seat in the crankcase.
Check the depth of stud bolt driving with a gauge, as indicated in the photograph. If it varies significantly from the driving depth indicated, it means that the stud bolt has yielded.
In this case, replace it.

By working on two fitted cylinder head fixing nuts, nut and locknut, as shown in the photograph, remove the stud bolt from its seat.
Clean the threaded seat on the carter thoroughly.
Refit a new stud bolt and apply the special product on the threading crankcase side.
Tighten up to the depth of the driving indicated.

Recommended products

'Super Fast' Loctite Strong 270 threadlock

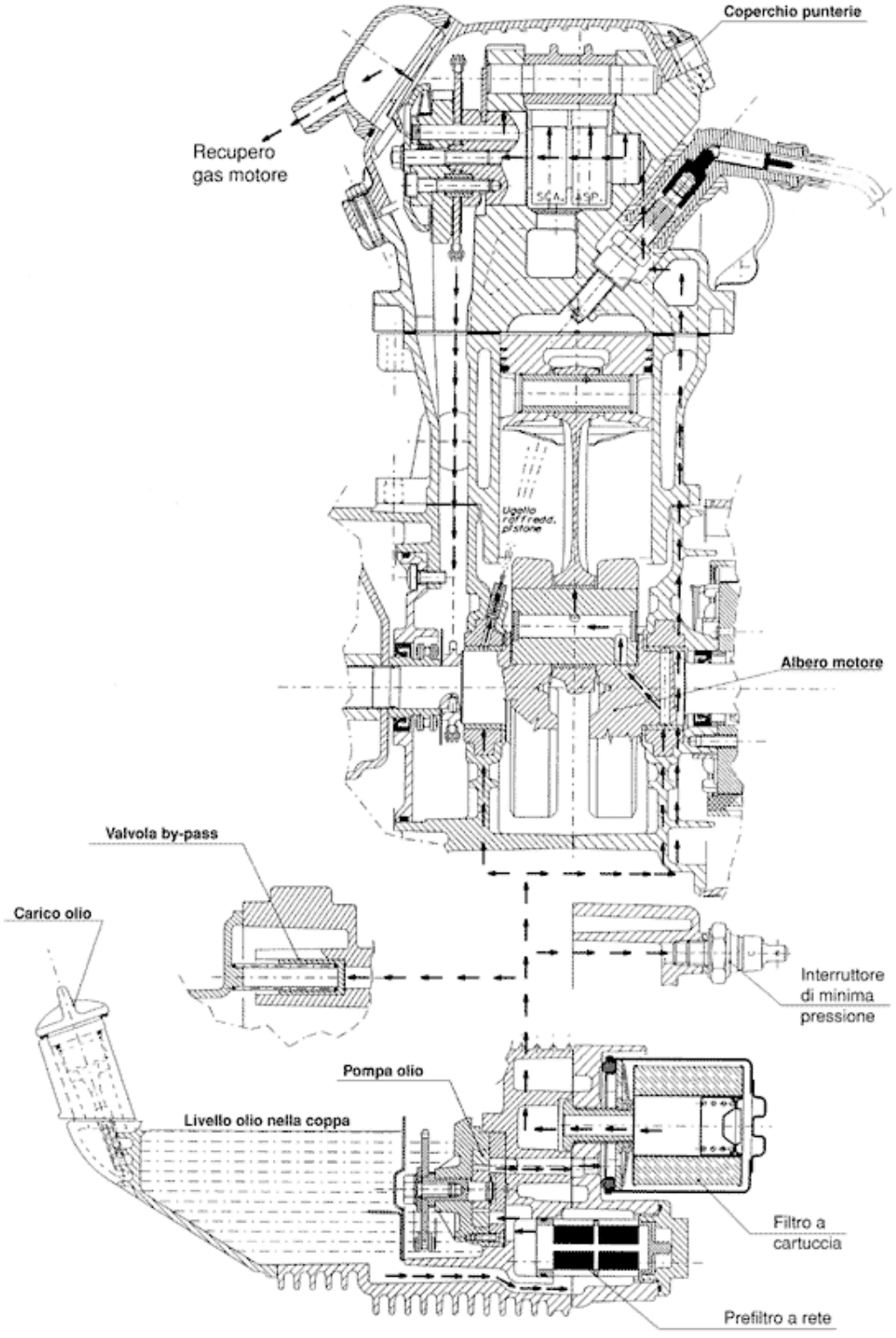
Strong 270 threadlock



Lubrication

Conceptual diagrams

LUBRICATION CIRCUIT



Oil pressure check

- Remove the electrical minimum oil pressure switch connection and remove the switch.
- Check the oil pressure reading is between 0.5 and 1.2 atm with the engine idling at 1650 r.p.m. and the oil at the required temperature (wait for at least one electric ventilation).
- Check the oil pressure is between 3.2 and 4.2 atm with the engine running at a speed 6000 r.p.m. and the oil at the required temperature.
- Remove the appropriate tools once the measurement is complete, refit the oil pressure switch and washer, tightening it to the specified torque and fit the fan cover.
- If the oil pressure is outside the specified limits, in the following order, check: the oil filter, the oil by-pass valve, the oil pump and the crankshaft seals.

N.B.

THE CHECK MUST BE CARRIED OUT WITH OIL AT THE CORRECT LEVEL AND WITH AN OIL FILTER IN GOOD CONDITION.

Characteristic

Oil pressure

Minimum pressure admitted at 6000 rpm: 3.2 atm.

Locking torques (N*m)

Minimum oil pressure sensor 12 - 14

Crankshaft oil seals

Removal

- Remove the transmission cover and the complete drive pulley beforehand

- Install the base of the appropriate tool on the oil guard using the screws provided.

Specific tooling

020622Y Transmission-side oil guard punch

- Screw the threaded bar onto the base of the tool and extract the oil guard.

Specific tooling

020622Y Transmission-side oil guard punch

Refitting

- Use a new oil guard for the refitting
- Prepare the new oil guard, lubricating the sealing lip.
- Pre-assemble the oil guard with the appropriate tool, positioning the screws.
- Insert the sheath over the crankshaft.
- Insert the tool with the oil seal on the crankshaft until it comes into contact with the crankcase.
- Insert the adaptor bushing of the tool in the hole on the crankcase.

- Orientate the oil guard by inserting the bracket which is part of the appropriate tool.
- Tighten the threaded bar onto the crankshaft as far as it will go.
- Use the nut to move the base of the tool until you can see end of the oil guard driving stroke
- Remove all of the tool components following the inverse procedure

CAUTION

DO NOT LUBRICATE THE SURFACE FOR KEYING ONTO THE ENGINE CRANKCASE.

CAUTION

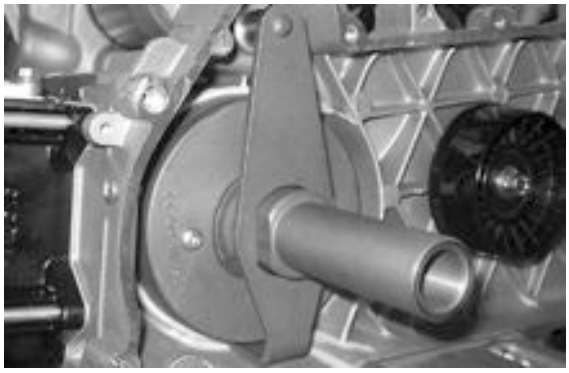
ORIENT THE OIL GUARD BY POSITIONING THE CHAIN HOUSING CHANNEL FACING DOWN-WARDS. WHEN THE POSITION IS REACHED, DO NOT RETRACT THE OIL GUARD. FAILURE TO COMPLY WITH THIS RULE CAN CAUSE A WRONG POSITIONING OF THE OIL GUARD SHEATH.

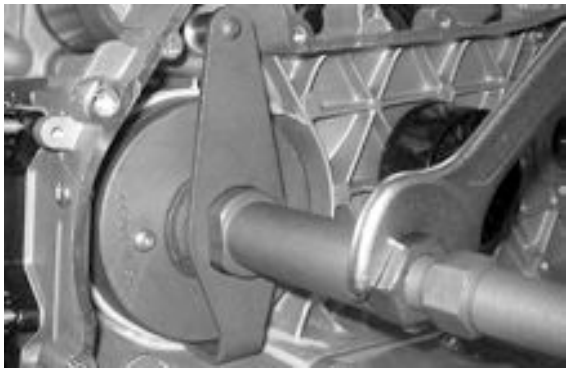
CAUTION

FAILURE TO COMPLY WITH THIS ASSEMBLY PRO-CEDURE CAN SERIOUSLY DAMAGE THE ENGINE DUE TO THE WRONG TENSIONING OF THE OIL PUMP CONTROL CHAIN.

Specific tooling

020622Y Transmission-side oil guard punch





Oil pump

Removal

- Undo the two clamping screws in the figure and remove the cover over the pump control crown.

- Block the rotation of the oil pump control pulley with a screwdriver inserted through one of its two holes.
- Remove the central screw with Belleville washer, as shown in the diagram.
- Remove the chain with the crown.
- Remove the control sprocket with relative O-ring.
- Remove the oil pump by unscrewing the two screws in the figure.
- Remove the oil pump seal.

N.B.

IT IS ADVISABLE TO MARK THE CHAIN IN ORDER TO ENSURE THAT THE INITIAL DIRECTION OF ROTATION IS MAINTAINED.

Inspection

- Remove the two screws and the oil pump cover.
- Remove the clip retaining the innermost rotor.
- Remove and wash the rotors thoroughly with petrol and compressed air.
- Reassemble the rotors in the pump body, keeping the two reference marks visible Replace the clip.
- Check the clearance between the rotors in the position shown in the diagram.

Measure the distance between the outer rotor and the pump body (see figure).

- Check the axial clearance of the rotors using a trued bar as shown in the figure.

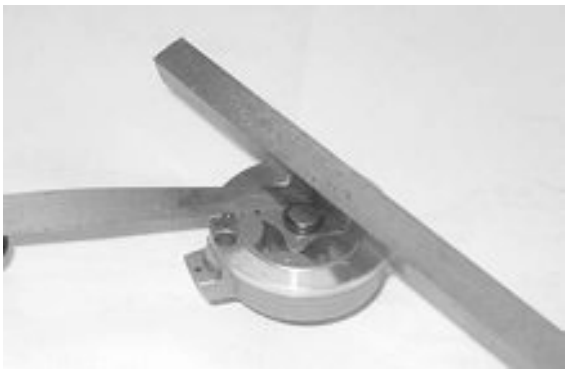
Characteristic

Axial rotor clearance

Limit values admitted: 0.09 mm

Distance between the outer rotor and the pump body

Admissible maximum clearance 0.20 mm



Distance between the rotors

Admissible maximum clearance 0.12 mm

Refitting

- Check there are no signs of wear on the oil pump shaft or body.
- Check there are no signs of scoring or wear on the oil pump cover.
- If you detect non-conforming measurements or scoring, replace the faulty parts or the assembly.
- Fit the pump cover in the position that permits the crankcase clamping screws to be aligned.
- Make sure the gasket is positioned properly and refit the pump on the engine crankcase. The

pump can only be fitted in one position. - Tighten the screws to the prescribed torque.

- Fit the sprocket wheel with a new O-ring.

- Fit the chain.

- Fit the pulley, the central screw and the Belleville washer. Tighten to the prescribed torque.

-Fit the oil pump cover, by tightening the two screws to the prescribed torque.

N.B.

FIT THE BELLEVILLE WASHER SO THAT ITS OUTER RIM TOUCHES THE PULLEY. MAKE SURE THAT THE PUMP TURNS FREELY.

Locking torques (N*m)

Screws mounting the oil pump to the crankcase 5 - 6 Oil pump command crown screw 10 ÷ 14 Oil pump cover screws 0.7 - 0.9

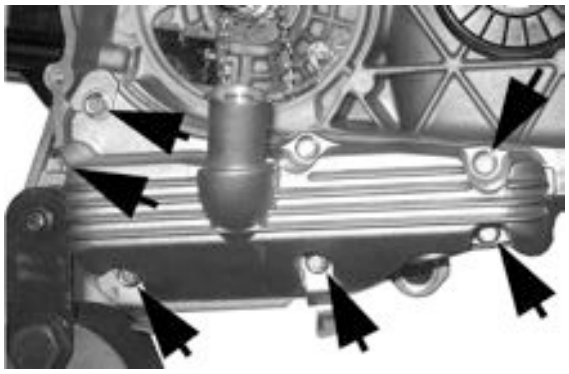
Removing the oil sump

- Remove the oil tank cap, the transmission cover, the complete drive pulley assembly with belt and the sprocket wheel, as described in the Transmission chapter.

- Drain the oil as described previously.

- Remove the seven screws, shown in the diagram, and the two rear brake fluid pipe fixing brackets.

- Remove the screw, the by-pass piston, the gasket and centring dowels shown in the figure.



Inspecting the by-pass valve

- Check the free length of the spring.
- Check that the small piston is not scored.
- Ensure that it slides freely on the crankcase and that it guarantees a good seal.
- If not, eliminate any impurities or replace defective parts.

Characteristic

By-pass check up: Standard length

54.2 mm

Refitting the oil sump

- Refit the by-pass valve plunger in its housing.
- Insert the pressure-regulating spring.
- Fit a new sump seal.
- Refit the two centring dowels.
- Refit the sump, taking care to locate the spring in the appropriate recess machined into the inside of the sump.
- Refit the rear brake cable brackets and the screws in the reverse order from which they were removed.
- Tighten the screws to the prescribed torque.
- Refit the drive pulley assembly, the drive belt, the sprocket wheel and the transmission cover, as described in the "Transmissions" chapter.

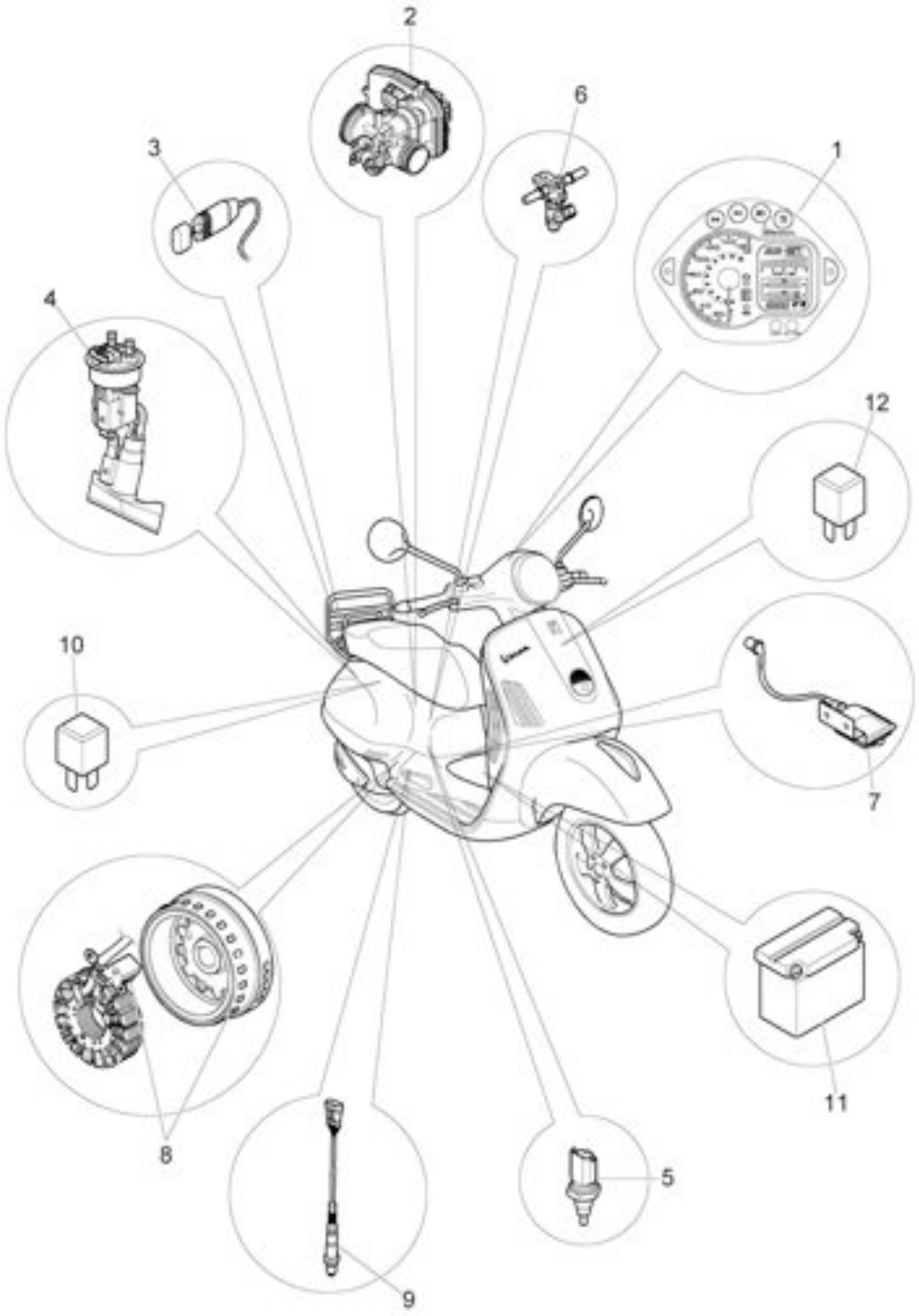
- When testing the lubrication system, refer to chapter "Crankcase and Crankshaft", regarding lubrication of the crankshaft and connecting rod

Locking torques (N*m)

Oil sump screws 10 ÷ 14

INDEX OF TOPICS

INJECTION	INJEC



TRANSPARENCY

	Specification	Desc./Quantity
1	Instrument panel	
2	Throttle body and electronic injection control unit (MIU)	
3	Diagnostics connector	
4	Fuel pump	
5	Water temperature sensor	
6	Fuel injector	
7	H.V. coil	
8	Engine rpm sensor	
9	Lambda probe	
10	Injection load remote control	
11	Battery	12 V - 12 Ah
12	Electric fan remote control switch	

MIU injection system

The injection system is the combined injection and ignition type.

Injection is indirect by means of electronic injectors into the manifold.

The injection and ignition are timed on the four-stroke cycle by means of a tone wheel keyed on to the crankshaft (24-2 teeth) and pick-up sensor.

Fuel preparation and ignition are controlled on the basis of the engine rpm and throttle valve opening.

Further adjustments are activated on the basis of the following parameters:

- Coolant temperature.
- Intake air temperature
- Lambda probe strength

The system activates an adjustment of the minimum fuel feed when the engine is cold by means of a stepper motor inserted on the throttle valve by-pass circuit. The control unit controls the stepper motor and the injector opening time thereby guaranteeing the stability of the idling and the correct fuel preparation.

In all conditions of use, fuel preparation is managed by modifying the injector opening time.

The fuel feed pressure is held steady in accordance with the environmental pressure.

The **fuel feed circuit** consists of:

- Fuel pump
- Fuel filter
- Injector

- Pressure regulator

The pump, filter and regulator are situated in the fuel tank on a single support.

The injector is connected by two snap-on pipes. This makes it possible to obtain continuous circulation thereby avoiding the risk of the fuel boiling. The pressure regulator is situated at the end of the circuit.

The fuel pump is controlled by the MIU; this ensures safety of the scooter.

The **ignition circuit** consists of:

- H.V. coil
- H.V. cable
- Shielded cap
- MIU
- Spark plug

The MIU manages the ignition with the best advance ensuring four-stroke timing (ignition only in the compression phase) at the same time.

The MIU injection-ignition system controls engine functions by means of a pre-set program.

If any input signals are missing, acceptable engine performance is anyway guaranteed to allow the user to reach the repair shop.

Of course this cannot happen when the phase rpm signal is missing, or when the fault concerns the control circuits:

- Fuel pump
- H.V. coil
- Injector

The control unit is provided with an auto-diagnosis system connected to an indicator light in the instrument panel.

Failures are detected and restored by the diagnostic tester.

In any case, when the fault has been fixed the stored value is automatically deleted after 16 us-

age cycles (cold start, running in temperature, stop).
The diagnostic tester is also required for adjusting the idle speed carburetion.

Specific tooling

020460Y Scooter diagnostics tester

The MIU injection-ignition carries out checks on the rpm counter and on the electric fan for radiator cooling.
The MIU control unit has decoder for the antitheft immobiliser.
The MIU control unit is connected to a diagnostics LED on the instrument panel, that also carries out the deterrent flashing functions.

The MIU control unit power supply is furthermore controlled by the emergency switch; this to ensure scooter security still further.

Precautions

Troubleshooting: Suggestions

1 A fault to the ECU system is most likely to be caused by the connections rather than the components. Before performing a diagnostic check on the ECU system, carry the following tests:

A: Electrical power supply

a. Battery voltage

b. Fuse, burst

c. Relays

d. Connectors

B: Earth on chassis

C: Fuel supply

a. Fuel pump, faulty

b. Fuel filter, dirty

D: Ignition system

a. Spark-plug, defective

b. Coil, faulty

c. Screened cap, faulty

E: Intake circuit

a. Air filter, dirty

b. By-pass circuit, dirty

c. Stepper motor, faulty

F: Other

a. Valve timing, incorrect

b. Idle carburetion, incorrect

c. Calibration of throttle valve opening sensor, incorrect

2 Anomalies to the ECU system may be caused by loosen connectors. Therefore, ensure that all connections are up to standard.

Check the connectors by observing the following:

A check the terminals are not bent.

B Check the connectors are fitted correctly.

B Check whether shaking the connector has any effect on the fault.

3 Before replacing the ECU check the whole system. If the anomaly disappears after replacing the ECU, install the original box back on the vehicle and check whether the anomaly reappears.

4 For diagnoses, use a multimeter with an internal resistance above 10KW /V. Inadequate instruments may damage the ECU. Instruments with an accuracy above 0.1V and 0.5W are preferred, the accuracy must be above 2%.

1.Before fixing any part of the injection system, check to see if there are any registered faults. Do not disconnect the battery before checking for faults.

2. The fuel feed system is pressurised at 250 KPa (2.5 BAR). Before disconnecting the snap-on attachment of a fuel line, check that there are no free flames and do not smoke. Act with caution to prevent spraying in the eyes.

3. When fixing electric components, operate with battery connected only when actually required.

4. When functional checks are performed, check that the battery voltage is more than 12V.

5. Before trying to start up, check to make sure there is at least two litres of fuel in the tank. Failure to respect this norm will damage the fuel pump.

6. If a long period of scooter downtime is planned, fill the tank to over the halfway mark. This will ensure the pump will be covered by fuel.

7. When washing the scooter, be careful of the electric components and wiring.

8. When an ignition fault is detected, start the checks from the battery and the injection system connections.

9. Before disconnecting the MIU connector, perform the following steps in the order shown:

- Turn the switch to the "OFF" position.
- Disconnect the battery

Failure to do this may damage the control unit.

10. Do not invert the polarity when fitting the battery.

11. To avoid damage, only disconnect and reconnect the MIU system connectors if required. Before reconnecting, check that the connectors are dry.

12. During electrical checks, do not force the tester tips into the connectors. Do not take measurements not specifically required by the manual.

13. At the end of every check performed with the diagnostic tester, protect the system connector with its cap. Failure to do this may damage the MIU.

14. Before reconnecting the snap-fittings of the power supply system, check that the terminals are perfectly clean.

Terminals setup

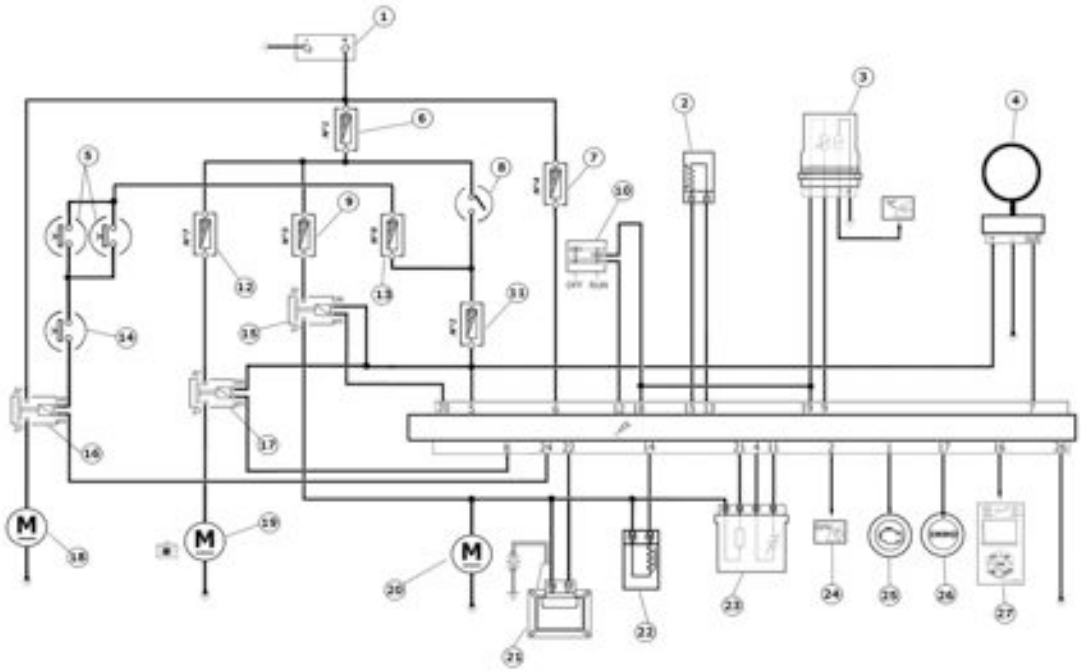
POSITIONING THE TERMINALS

	Specification	Desc./Quantity
1	Injection warning light	
2	Revolution counter sensor	
3	-	
4	- Lambda probe	
5	+ Permanent battery power supply	
6	+ Battery	

	Specification	Desc./Quantity
7	Immobiliser antenna	
8	Electric fan remote control switch	
9	Water temperature sensor	
10	-	
11	+ Lambda probe	
12	Engine stop switch	
13	R.P.M. sensor (+)	
14	Fuel injector	
15	R.P.M. sensor (-)	
16	Diagnostics socket	
17	Immobiliser LED	
18	Side stand	short circuited on pin 19
19	Earth	Connected with: water temperature sensor, engine stop, side stand.
20	Injection load remote control	
21	Lambda probe heater	
22	H.V. coil	
23	-	
24	Start up enabling	
25	-	
26	Ground wire	

EMS circuit diagram

Schema valido dal numero di telaio ZAPM4510000001579 in poi.

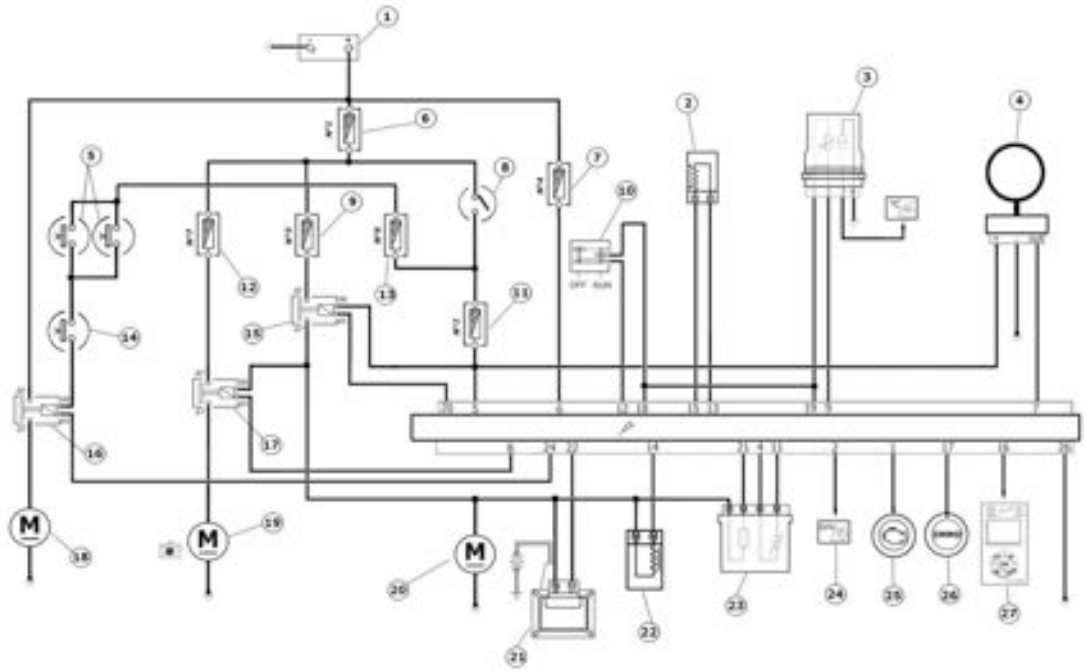


CIRCUIT DIAGRAM

	Specification	Desc./Quantity
1	Battery	12 V - 12 Ah
2	Engine rpm sensor	
3	Water temperature sensor	
4	Immobiliser antenna	
5	Stop button	
6	Fuse	30 A
7	Fuse	3 A
8	Key switch contacts	
9	Fuse	10A
10	Engine stop switch	
11	Fuse	7.5 A
12	Fuse	15A
13	Fuse	7.5 A
14	Starter button	
15	Injection load remote control	
16	Starter remote control	
17	Electric fan remote control switch	
18	Starter motor	
19	Electric fan	

	Specification	Desc./Quantity
20	Fuel pump	
21	H.V. coil	
22	Fuel injector	
23	Lambda probe	
24	Rev counter	
25	"WARNING" light	
26	Immobiliser LED	
27	Diagnostics connector	

Lo schema sottostante è valido per i telai dal numero ZAPM4510000001007 al ZAPM4510000001578. Per i telai successivi consultare la pagina 2.



CIRCUIT DIAGRAM

	Specification	Desc./Quantity
1	Battery	12 V - 12 Ah
2	Engine rpm sensor	
3	Water temperature sensor	
4	Immobiliser antenna	
5	Stop button	
6	Fuse	30 A

	Specification	Desc./Quantity
7	Fuse	3 A
8	Key switch contacts	
9	Fuse	10A
10	Engine stop switch	
11	Fuse	7.5 A
12	Fuse	15A
13	Fuse	7.5 A
14	Starter button	
15	Injection load remote control	
16	Starter remote control	
17	Electric fan remote control switch	
18	Starter motor	
19	Electric fan	
20	Fuel pump	
21	H.V. coil	
22	Fuel injector	
23	Lambda probe	
24	Rev counter	
25	"WARNING" light	
26	Immobiliser LED	
27	Diagnostics connector	

Troubleshooting procedure

Engine does not start

ENGINE DOES NOT START EVEN IF ONLY TRAILING

Possible Cause	Operation
Immobiliser signal	System not coded Inefficient system, fix according to the auto-diagnosis instructions
Fault detected by autodiagnosis	Pump relay H.V. coil Injector Rotation sensor
Fuel supply	Fuel in the tank Activation of the fuel pump

Possible Cause	Operation
	Fuel pressure (low) Injector capacity (low)
Spark plug power supply	Spark plug shielded Cap HT coil (secondary isolation).
Parameter reliability	coolant temperature Distribution timing - injection/ignition Temperature of intake air
Compression end pressure	Compression end pressure
Parameter reliability	coolant temperature Distribution timing - injection/ignition Sucked air temperature

Starting difficulties

ENGINE START-UP PROBLEMS

Possible Cause	Operation
Presence of faults detected by the self diagnosis	Pump relay H.V. coil Injector Phase rpm sensor Air temperature Coolant temperature.
Starting	Starter motor and remote control switch Battery Earth connections
Compression end pressure	Compression end pressure
Spark plug power supply	Spark plug Screened cap H.V. coil Rotation sensor Ignition timing
Fuel supply	Fuel pressure (low) Injector capacity (low) Injector seal (poor)
Parameter correctness	coolant temperature Sucked air temperature throttle valve position stepper (effective steps and opening) Cleaning of the auxiliary air duct and of the throttle valve air filter efficiency

Engine stops at idle

ENGINE DOES NOT HOLD IDLING/ IDLING IS UNSTABLE/ IDLING TOO LOW

Possible Cause	Operation
Presence of faults detected by the self diagnosis	Pump relay H.V. coil Injector Phase rpm sensor Air temperature Coolant temperature.
Ignition efficiency	Spark plug Ignition timing
Parameter correctness	Throttle valve position sensor Stepper Coolant temperature sensor Sucked air temperature sensor
Intake system cleaning	Air filter Throttle valve and choke Stepper and additional air duct
Intake system seal (infiltrations)	Intake manifold - head Throttle body - manifold Intake manifold Filter box
Fuel supply (low pressure)	Fuel pump Pressure regulator Fuel filter Injector capacity

Engine does not rev down

ENGINE DOES NOT RETURN TO THE IDLING SPEED/IDLING SPEED TOO HIGH

Possible Cause	Operation
Presence of faults detected by the self diagnosis	Pump relay H.V. coil Injector Phase rpm sensor Air temperature Coolant temperature.
Ignition efficiency	Ignition timing
Parameter correctness	Throttle valve position sensor Stepper Coolant temperature sensor Sucked air temperature sensor
Intake system seal (infiltrations)	Intake manifold - head Throttle body - manifold Intake manifold Filter box
Fuel supply (low pressure)	Fuel pump

Possible Cause	Operation
	Pressure regulator Fuel filter Injector capacity

Exhaust backfires in deceleration

EXHAUST BACKFIRING WHILE SLOWING DOWN

Possible Cause	Operation
Presence of faults detected by the self diagnosis	Pump relay H.V. coil Injector Phase rpm sensor Air temperature Coolant temperature. Lambda probe
Parameter correctness	Throttle valve position sensor Stepper Coolant temperature sensor Sucked air temperature sensor
Intake system seal (infiltrations)	Intake manifold - head Throttle body - manifold Intake manifold Filter box
Fuel supply (low pressure)	Fuel pump Pressure regulator Fuel filter Injector capacity
Exhaust system (infiltration) seal	Manifold - cylinder head Manifold - muffler Muffler welding

Engine revs irregularly

IRREGULAR PROGRESS OF THE ENGINE WITH VALVE SLIGHTLY OPEN

Possible Cause	Operation
Intake system cleaning	Air filter Throttle valve and choke Stepper and additional air duct
Intake system cleaning	Intake manifold Filter box
Ignition system	Spark plug wear check
Parameter reliability	Throttle valve position signal coolant temperature signal Sucked air temperature signal

Possible Cause	Operation
	Ignition timing
TPS reset performed successfully	TPS reset performed successfully
Presence of faults detected by the self diagnosis	Pump relay H.V. coil Injector Phase rpm sensor Air temperature Coolant temperature. Lambda probe

Poor performance at full throttle

POOR ENGINE PERFORMANCE AT FULL POWER/ IRREGULAR ENGINE PROGRESS ON PICKUP

Possible Cause	Operation
Presence of faults detected by the self diagnosis	Pump relay H.V. coil Injector Phase rpm sensor Air temperature Coolant temperature. Lambda probe
Spark plug power supply	Spark plug Screened cap H.V. cable H.V. coil
Intake system	Air filter Filter box (seal) Intake manifold (seal)
Parameter reliability	Throttle valve position signal coolant temperature signal Sucked air temperature signal Ignition timing
Fuel supply	Fuel level in the tank Fuel pressure Fuel filter Injector capacity

Engine knocking

PRESENCE OF KNOCKING (OVERHEAD KNOCKING)

Possible Cause	Operation
Presence of faults detected by the self diagnosis	Pump relay H.V. coil

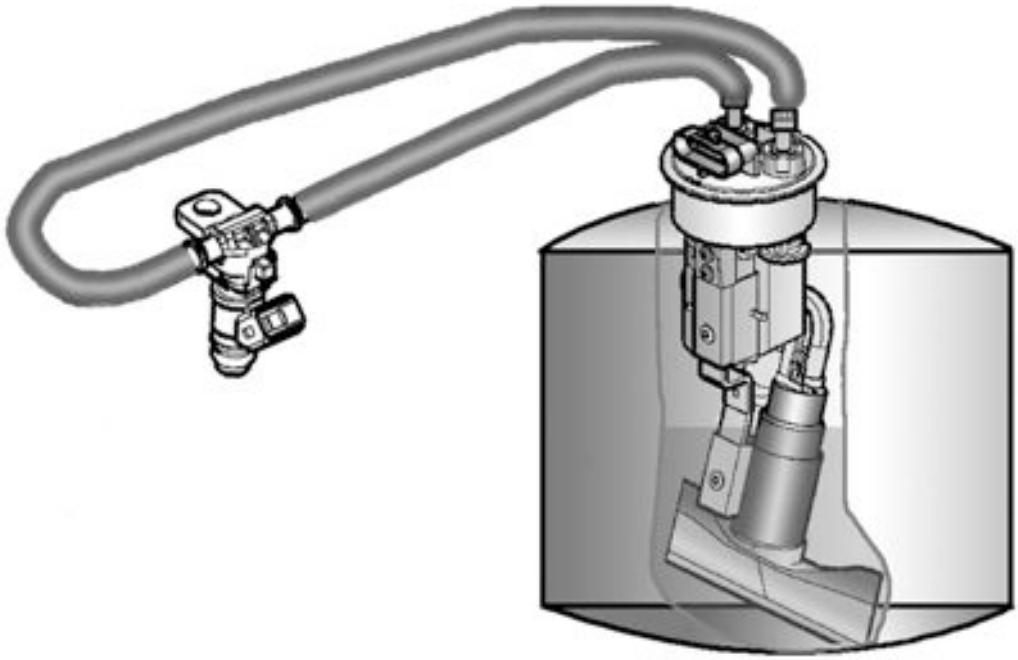
Possible Cause	Operation
	Injector Phase rpm sensor Air temperature Coolant temperature. Lambda probe
Ignition efficiency	Spark plug
Parameter reliability	Throttle valve position signal coolant temperature signal Sucked air temperature signal Ignition timing
Intake system cleaning	Intake manifold Filter box
TPS reset performed successfully	TPS reset performed successfully
Fuel supply	Fuel pressure Fuel filter Injector capacity Fuel quality
Selection of the cylinder base gasket thickness	Selection of the cylinder base gasket thickness

Fuel supply system

The fuel supply circuit includes the electric pump, the filter, the pressure regulator. the electro-injector and the delivery and return pipes.

The electrical pump is located in the tank from which the fuel is pumped and sent to the injector through the filter.

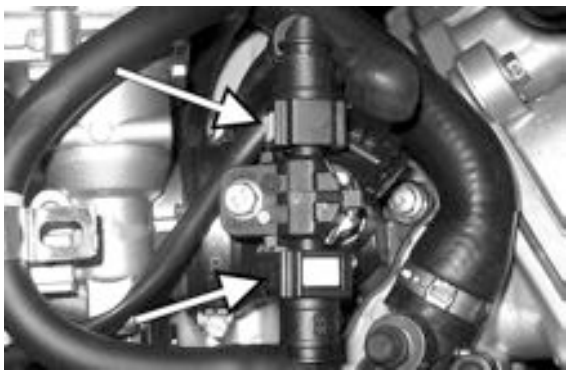
The pressure is controlled by the pressure regulator situated in the pump assembly in the tank.



Removing the butterfly valve

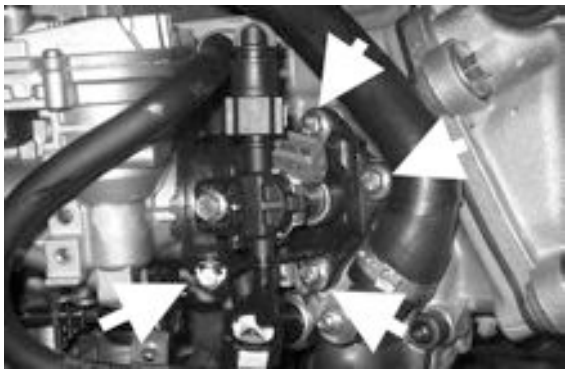
Remove the fuel piping clamping screw indicated in the figure.

Remove the snap-on fittings from the injector support

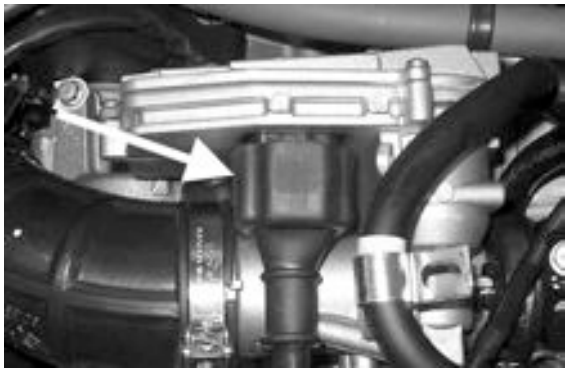


Remove the injector connector

Remove the three screws fixing the manifold to the cylinder head and the clip fixing the throttle body to the manifold.

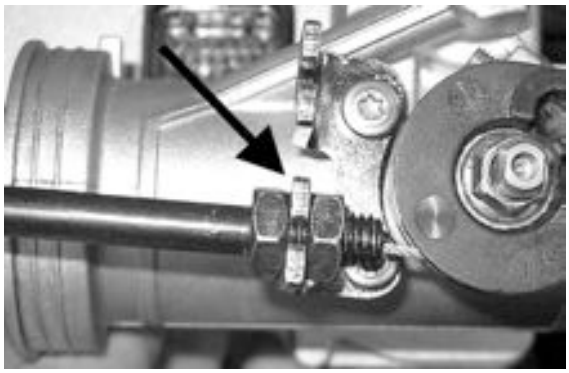


Remove the MIU connector



Remove the clip fixing the throttle body to the purifier bellows

Remove the gas command fitting as indicated in the photograph

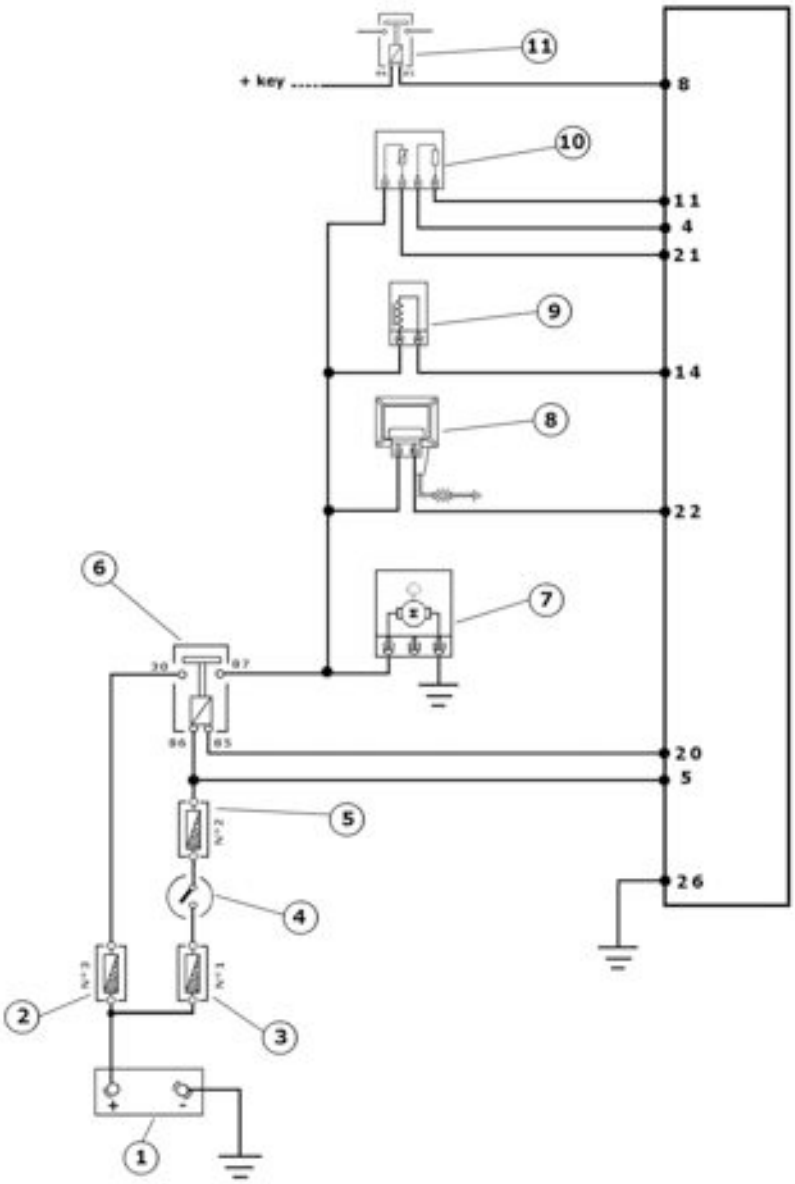


Refitting the butterfly valve

To refit, perform the operations in the reverse order from the removal operations being careful to position the clip fixing the throttle body to the air filter bellows at 45° as shown in the photograph.

Pump supply circuit

Schema valido dal numero di telaio ZAPM4510000001579 in poi.

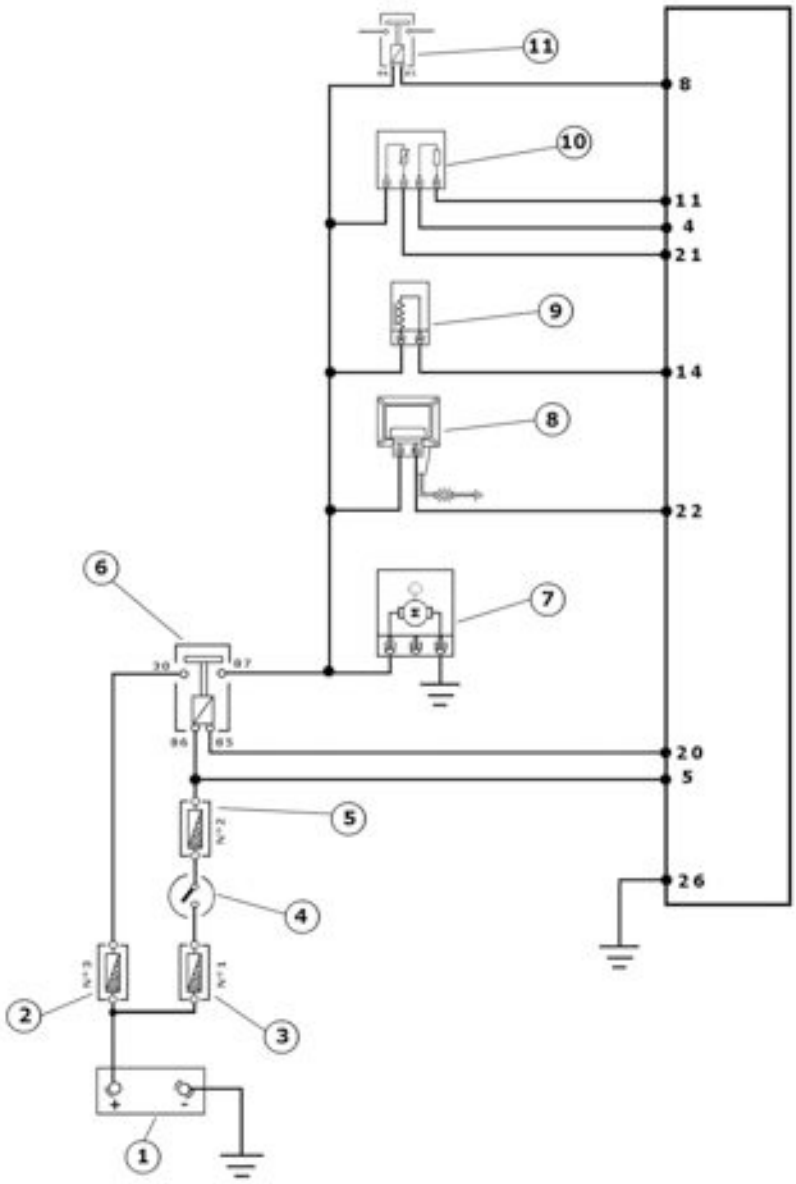


TEMPERATURE SENSOR 1

	Specification	Desc./Quantity
1	Battery	12 V - 12 Ah
2	Fuse	10A
3	Fuse	30 A
4	Key switch contacts	
5	Fuse	7.5 A
6	Injection load remote control	
7	Fuel pump	
8	H.V. coil	
9	Fuel injector	

	Specification	Desc./Quantity
10	Lambda probe	
11	Electric fan remote control switch	

Lo schema sottostante è valido per i telai dal numero ZAPM4510000001007 al ZAPM4510000000001578. Per i telai successivi consultare la pagina 2.



TEMPERATURE SENSOR 1

	Specification	Desc./Quantity
1	Battery	12 V - 12 Ah
2	Fuse	10A
3	Fuse	30 A

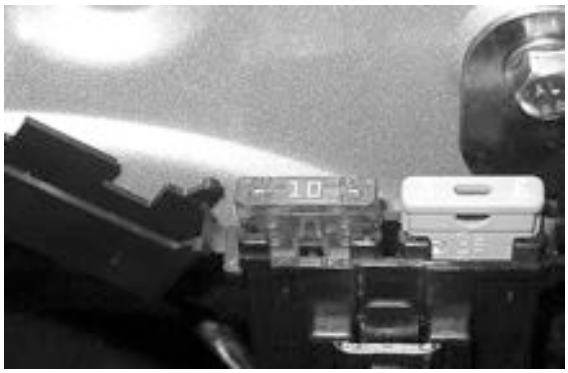
	Specification	Desc./Quantity
4	Key switch contacts	
5	Fuse	7.5 A
6	Injection load remote control	
7	Fuel pump	
8	H.V. coil	
9	Fuel injector	
10	Lambda probe	
11	Electric fan remote control switch	

When switched to "ON", the fuel pump starts to rotate for two seconds then stops. When the engine starts up, in the presence of phase rpm signal the pump is continuously supplied.

ELECTRICAL DATA

- Pump winding resistance approx. 1.5 ohms
- Input current during normal functioning 1.4 to 1.8 A
- Input current to the closed hydraulic circuit approx. 2 A (to be checked with appropriate tool for fuel pressure control choking the circuit on the return pipe)

Check the integrity of the 10A injection loads fuse, no. 3.
Check the integrity of the 7.5A ignition key-switch fuse, no. 2.



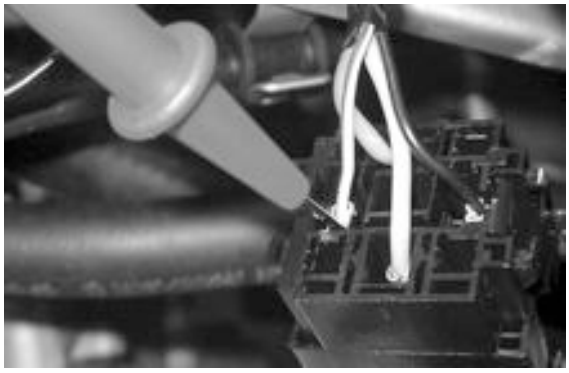
Check the efficiency of the injection load remote control: Check the resistance of the energising coil between pins 86 and 85: 40 to 80 Ohm
Apply a voltage of 12V to pins 86 and 85 and make sure that there is continuity between pins 30 and 87 of the remote control.

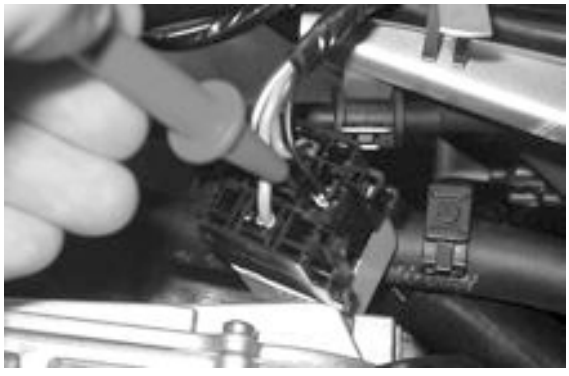
Check the wiring to the injection loads relay coil: turning the key-switch onto "ON", check for bat-

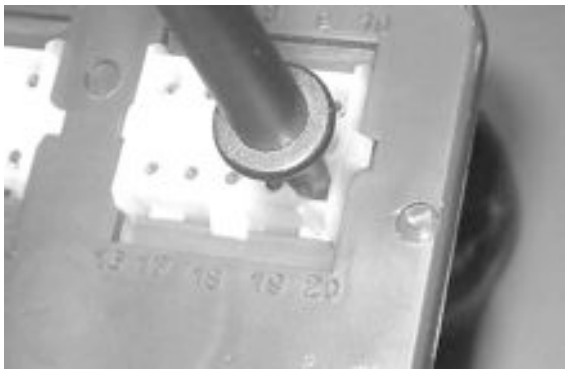
tery voltage, for 2 seconds, between the Red-White and Black-Purple wires on the relay step. Otherwise, check for continuity, on the Red-White wire, between the fuse holder underneath the seat and the relay step, and on the Black-Purple wire, between pin 20, on the box, and the relay step.

N.B.

CONTINUITY TESTS MUST BE CARRIED OUT WITH THE COMPONENTS DISCONNECTED. (REMOTE CONTROLS, CONTROL UNIT, FUSES ETC.).



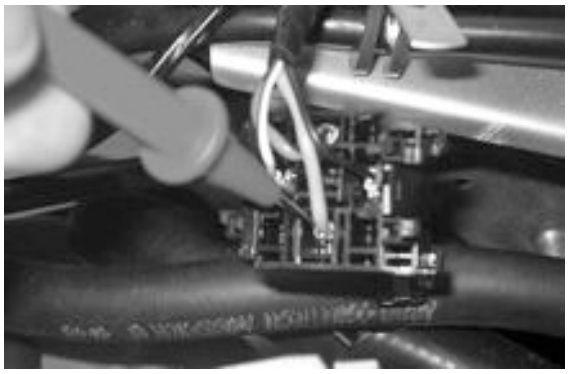


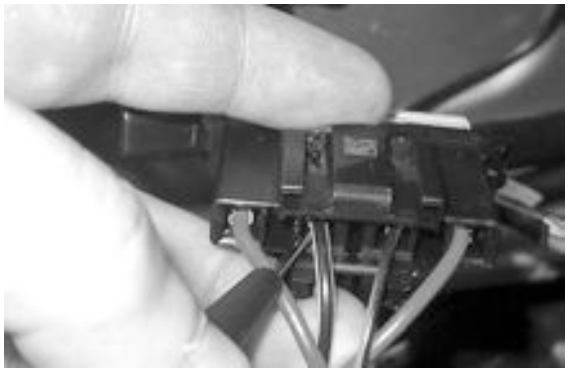


Check for the presence of DC voltage between the Grey-Black wire on the relay step and earth. Otherwise, check for continuity on the Grey-Black wire, between the fuse box (10A fuse no. 3) and the relay step.

N.B.

CONTINUITY TESTS MUST BE CARRIED OUT WITH THE COMPONENTS DISCONNECTED. (REMOTE CONTROLS, CONTROL UNIT, FUSES ETC.).



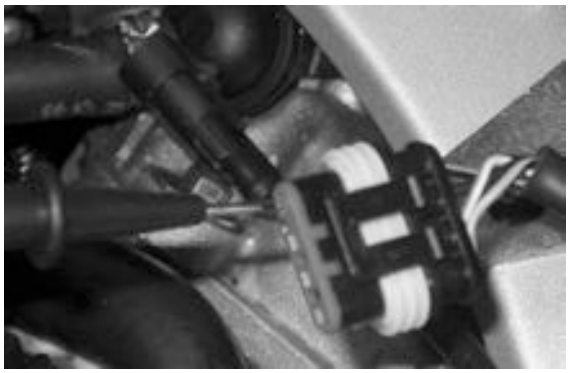


Check, on switching to "ON", that there is battery voltage, for about two seconds, to the Black-Green cable of the pump connector and earth with pump connector disconnected. Otherwise

check the continuity of the Black-Grey cable between the pump connector and the base of the remote control.

Check the efficiency of the earth line of the fuel pump by measuring the continuity between the pump connector's black cable, system side, and the earth.

If, when switching to "ON", the pump continues to turn after two seconds of activation, check, with the control unit disconnected and the injection load remote control disconnected, that the Black-Purple cable (pin 20 on the interface wiring) is insulated from the earth.

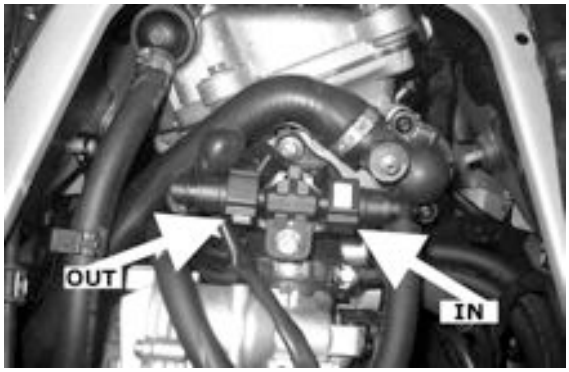


Specific tooling

020331Y Digital multimeter

Circuit leak test

Install the appropriate tool for fuel pressure control with the pipe fitted with the pressure gauge on the delivery pipe..



Check during normal functioning by placing the appropriate tool between the pump and the injector.

With the battery voltage> 12 V check that the fuel pressure is 2.5 BAR and that the input current is 1.4 to 1.8 A

With the battery voltage > 12 V, check the capa-

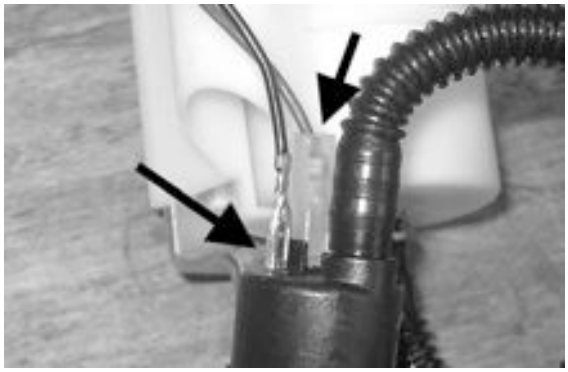
city of the pump flow rate by disconnecting from the injector the pipe equipped with the pressure gauge of the appropriate tool . Make a graded burette available with a flow rate of approximately 1 L. Rotate the pump using the active diagnosis of the palm top computer. Using a pair of long flat needle-nose pliers, choke the fuel pipe making the pressure stabilise at approx. 2.5 bar. Check that, in fifteen seconds, the pump has a flow rate of around 110cc.

Specific tooling

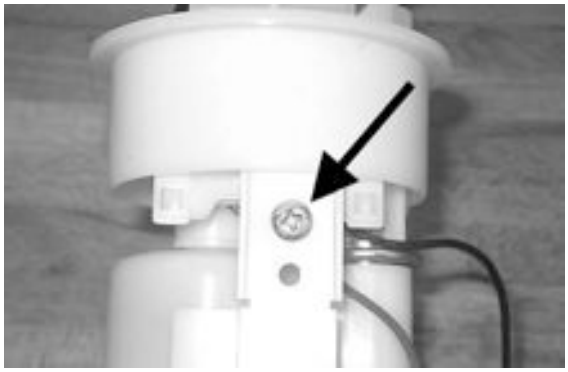
020480Y Fuel pressure check kit

Fuel filter check

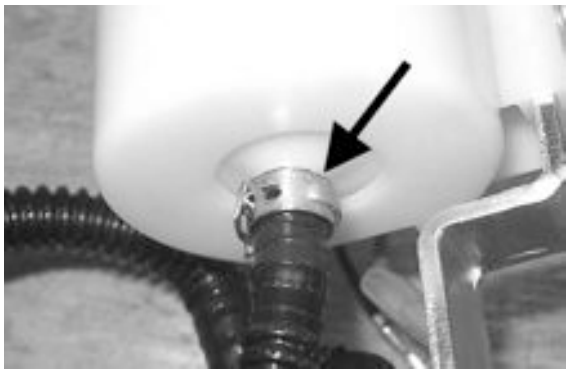
Disconnect the terminals from the electric pump



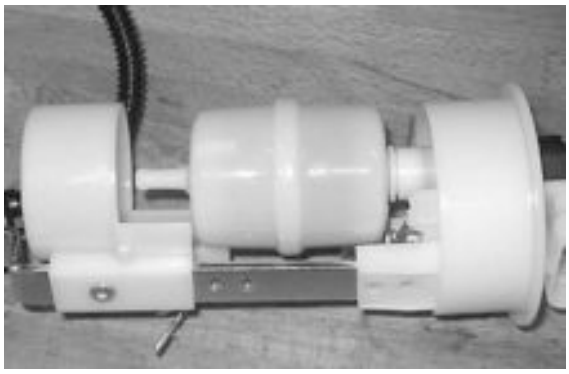
Remove the screw shown in the photograph



Remove the clip fixing the piping to the filter shown in the photograph



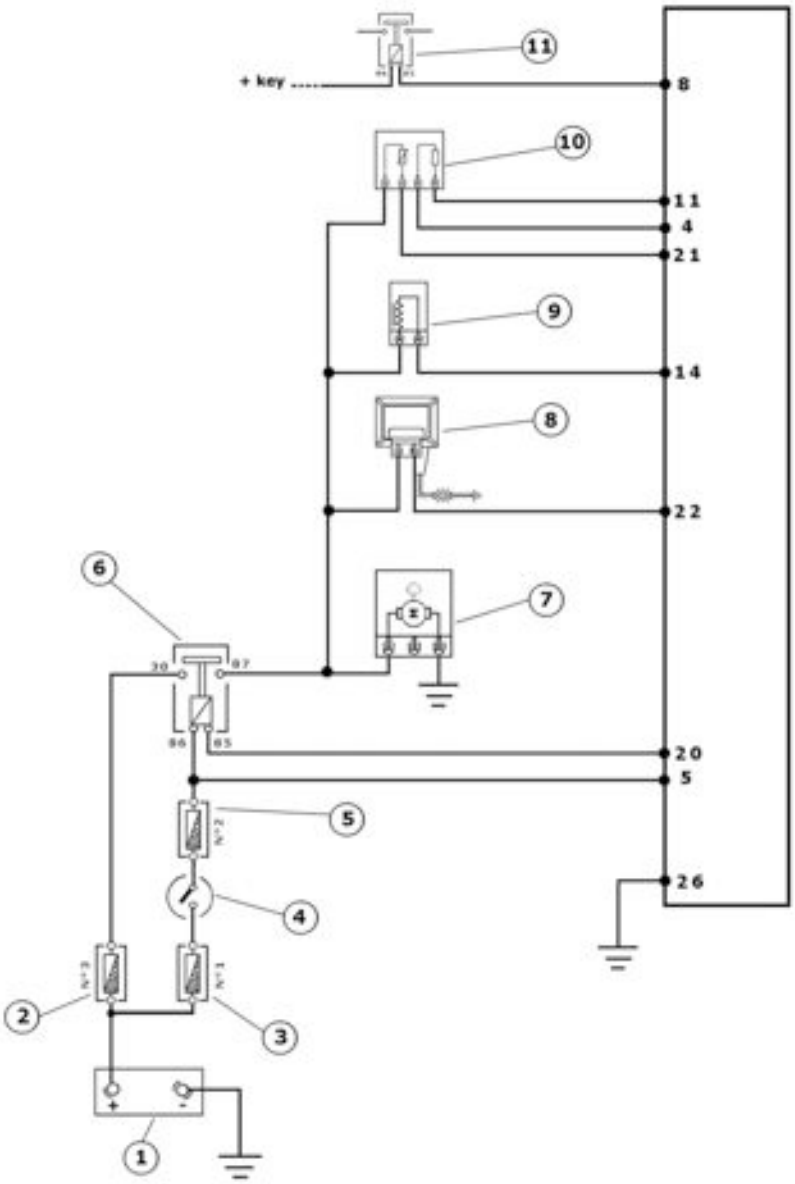
Separate the lower part of the pump support as shown in the photograph.



Remove the filter from the pump support

Inspecting the injector circuit

Schema valido dal numero di telaio ZAPM4510000001579 in poi.

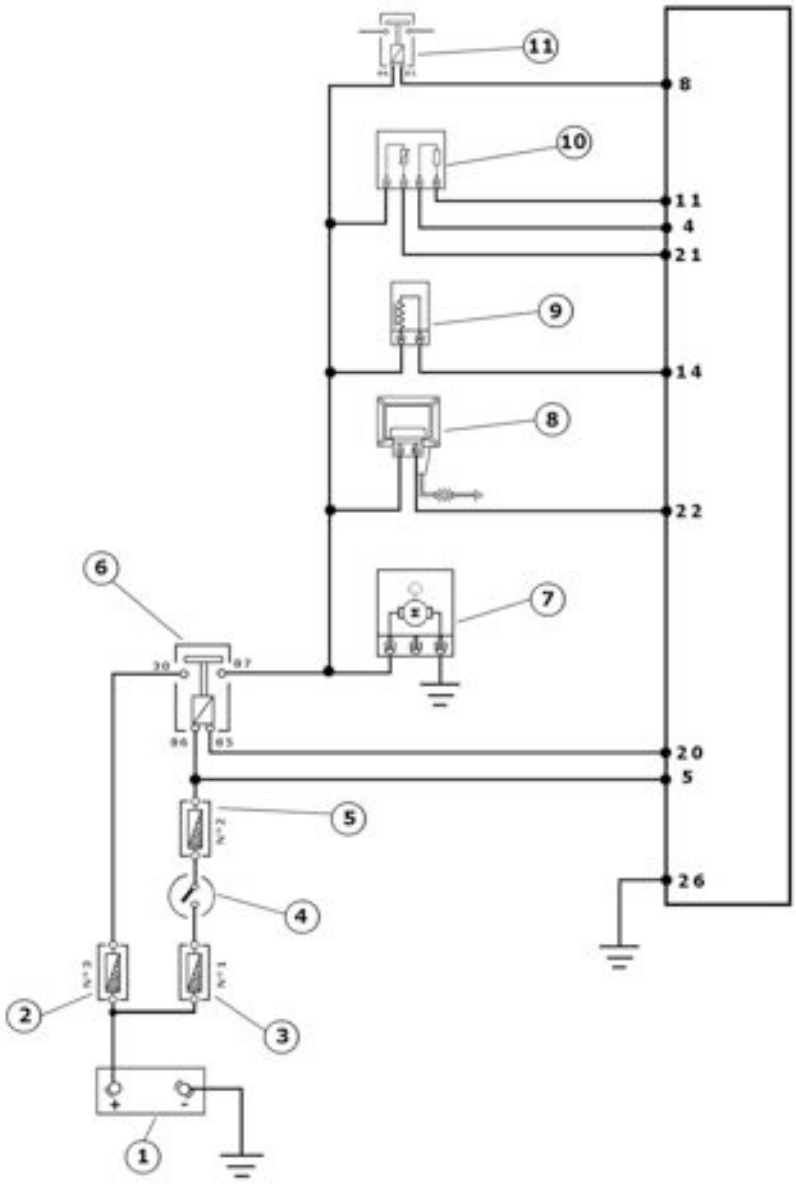


TEMPERATURE SENSOR 1

	Specification	Desc./Quantity
1	Battery	12 V - 12 Ah
2	Fuse	10A
3	Fuse	30 A
4	Key switch contacts	
5	Fuse	7.5 A
6	Injection load remote control	
7	Fuel pump	
8	H.V. coil	
9	Fuel injector	

	Specification	Desc./Quantity
10	Lambda probe	
11	Electric fan remote control switch	

Lo schema sottostante è valido per i telai dal numero ZAPM4510000001007 al ZAPM4510000000001578. Per i telai successivi consultare la pagina 2.



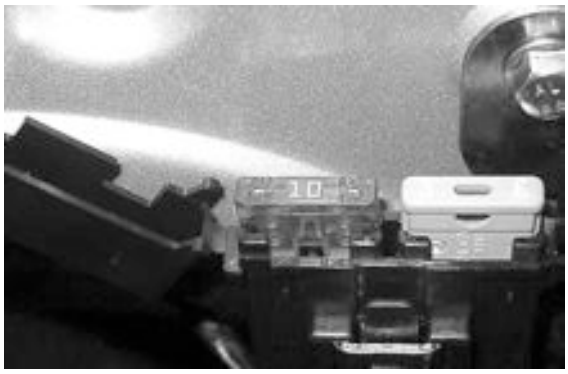
TEMPERATURE SENSOR 1

	Specification	Desc./Quantity
1	Battery	12 V - 12 Ah
2	Fuse	10A
3	Fuse	30 A

	Specification	Desc./Quantity
4	Key switch contacts	
5	Fuse	7.5 A
6	Injection load remote control	
7	Fuel pump	
8	H.V. coil	
9	Fuel injector	
10	Lambda probe	
11	Electric fan remote control switch	

Check of the resistance at the injector ends: 14.5 ± 5% ohms

Check the integrity of the 10A injection loads fuse, no. 3.
Check the integrity of the 7.5A ignition key-switch fuse, no. 2.



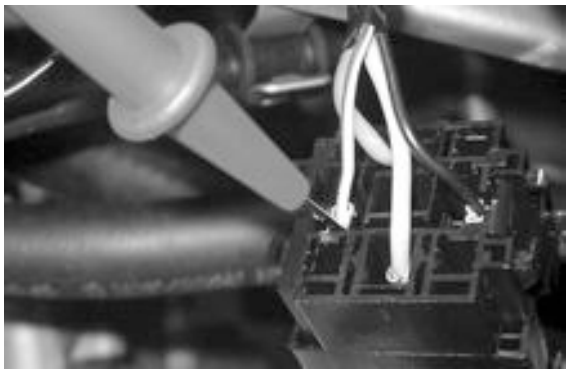
Check the efficiency of the injection load remote control: Check the resistance of the energising coil between pins 86 and 85: 40 to 80 Ohm
Apply a voltage of 12V to pins 86 and 85 and make sure that there is continuity between pins 30 and 87 of the remote control.

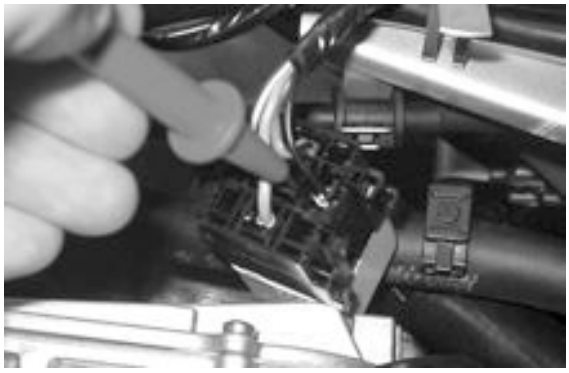
Check the wiring to the injection loads relay coil: turning the key-switch onto "ON", check for battery voltage, for 2 seconds, between the Red-White and Black-Purple wires on the relay step. Otherwise, check for continuity, on the Red-White wire, between the fuse holder underneath the seat and the relay step, and on the Black-Purple wire, between pin 20, on the box, and the relay

step.

N.B.

CONTINUITY TESTS MUST BE CARRIED OUT WITH THE COMPONENTS DISCONNECTED. (REMOTE CONTROLS, CONTROL UNIT, FUSES ETC.).



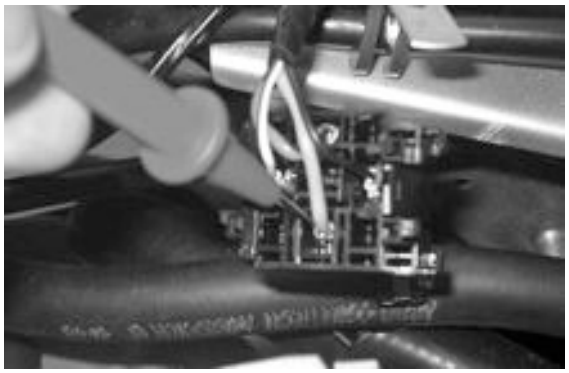


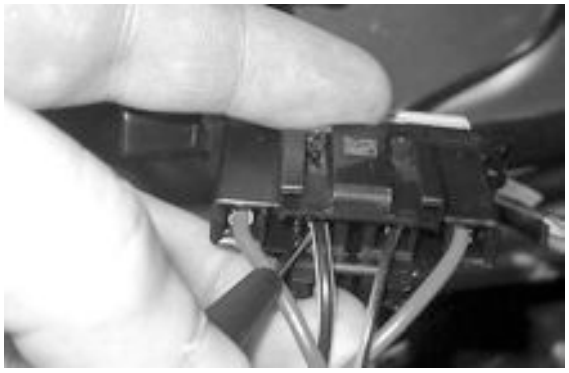
Check for the presence of DC voltage between the Grey-Black wire on the relay step and earth. Otherwise, check for continuity on the Grey-Black wire, between the fuse box (10A fuse no. 3) and

the relay step.

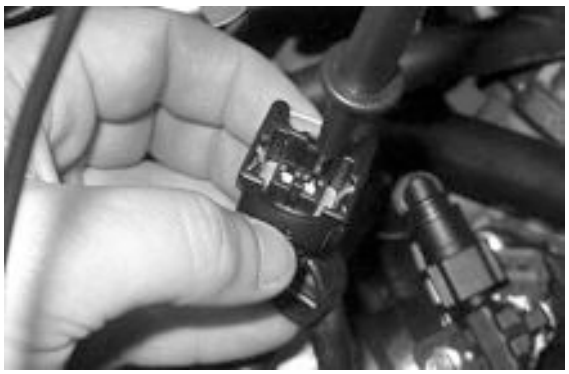
N.B.

CONTINUITY TESTS MUST BE CARRIED OUT WITH THE COMPONENTS DISCONNECTED. (REMOTE CONTROLS, CONTROL UNIT, FUSES ETC.).





With the control unit and the injector disconnected, check the continuity of the Red-Yellow cable between pin 14 of the interface wiring and the injector connector

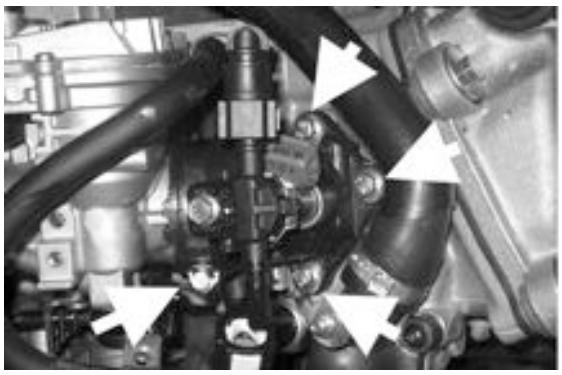


Switch to "ON" and check the presence of voltage, with injector disconnected and control unit connected, between the Black-Green cable of the injector connector and the earth

With injector disconnected and the injector load remote control disconnected, check the continuity of the Black-Green cable between the injector connector and remote control base.

Inspecting the injector hydraulics

To carry out the injector check, remove the intake manifold by removing the three clamping screws at the head and the clip connecting the control unit to the manifold.



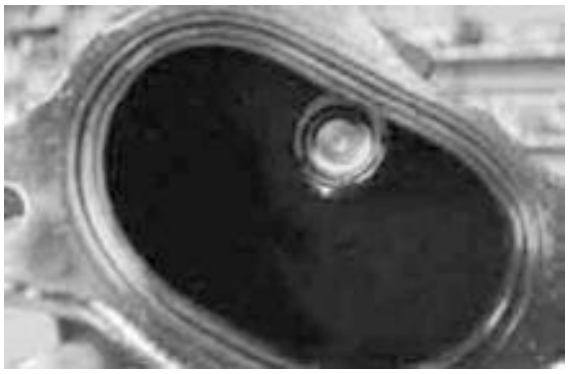
Install the appropriate tool for the fuel pressure check and position the manifold over a container graduated by at least 100 cc. Connect the injector with the cable making up part of the supply for the injection tester. Connect the clamps of the cable to an auxiliary battery. Activate the fuel pump with the active diagnosis. Check that, in fifteen seconds, approximately 40 cc of fuel is dispensed with a regulation pressure of approximately 2.5

BAR.

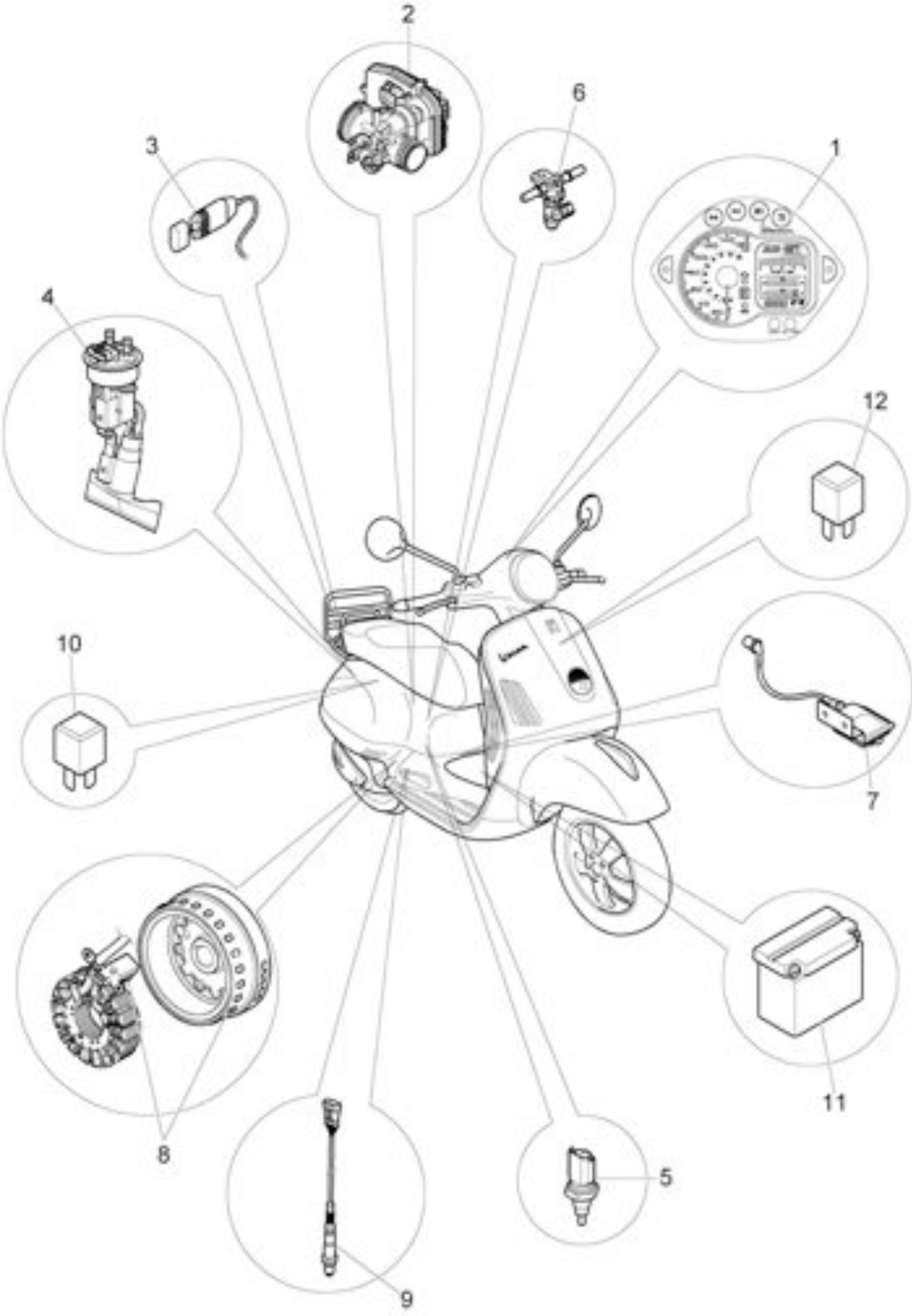
Specific tooling

020480Y Fuel pressure check kit

Proceed with the injector seal test.
Dry the injector outlet with a blast of compressed air. Activate the fuel pump. Wait for one minute, making sure there are no leaks coming from the injector. Slight oozing is normal.
Value limit = 1 drop per minute



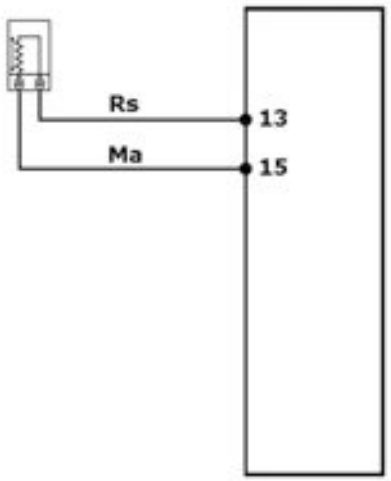
Components location



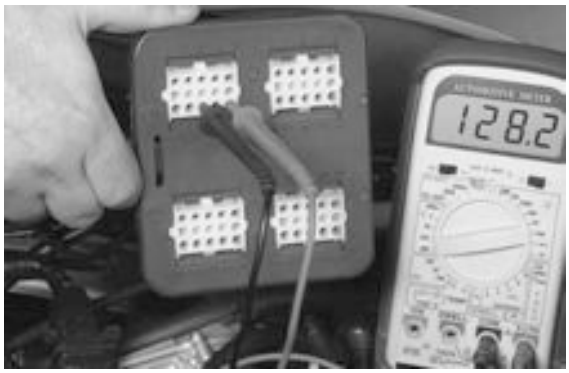
COMPONENTS LOCATION

	Specification	Desc./Quantity
1	Instrument panel	
2	Throttle body and electronic injection control unit (MIU)	
3	Diagnostic inlet	
4	Fuel pump	
5	Water temperature sensor	
6	Fuel injector	
7	H.V. coil	
8	Flywheel- phase revolutions indicator	
9	Lambda probe	
10	Injection load remote control	
11	Battery	12 V - 12 Ah
12	Electric fan remote control switch	

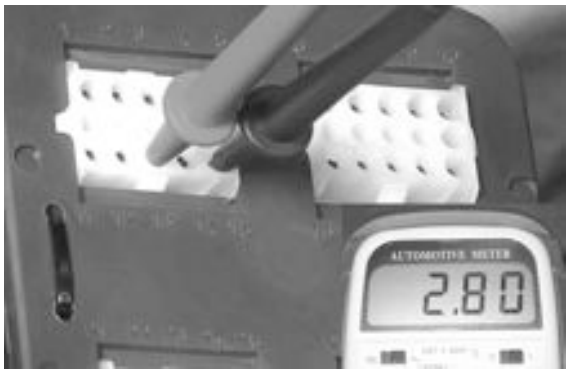
Tachometer



With wiring disconnected from the control unit and connected to the system, check that the sensor resistance between pins 13 - 15 is between 100 and 150 ohm at an engine temperature of approximately 20°



Disconnect the fuel pipe connector. Start up the engine and wait for it to stop. With the wiring connected to the control unit and system try to start up the engine and check that the voltage between pins 13 and 15 is around 2.8 V



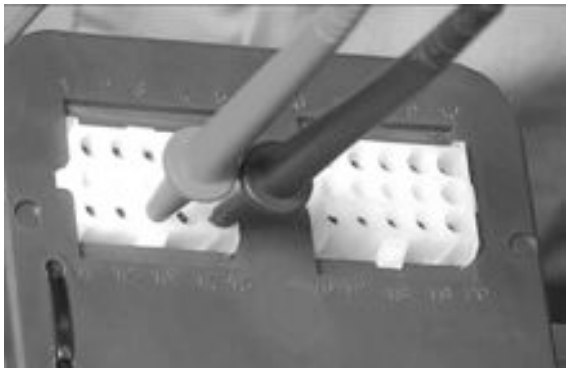
With the interface cabling disconnected from the control unit, check that the continuity between pin 13 and the red cable of the rpm sensor connector and between pin 15 and brown cable of the rpm sensor connector

With the interface wiring disconnected from the control unit and rpm sensor connector, check that the red and brown cables (pin 13 - 15) are isolated from each other and insulated from the earth.

Specific tooling

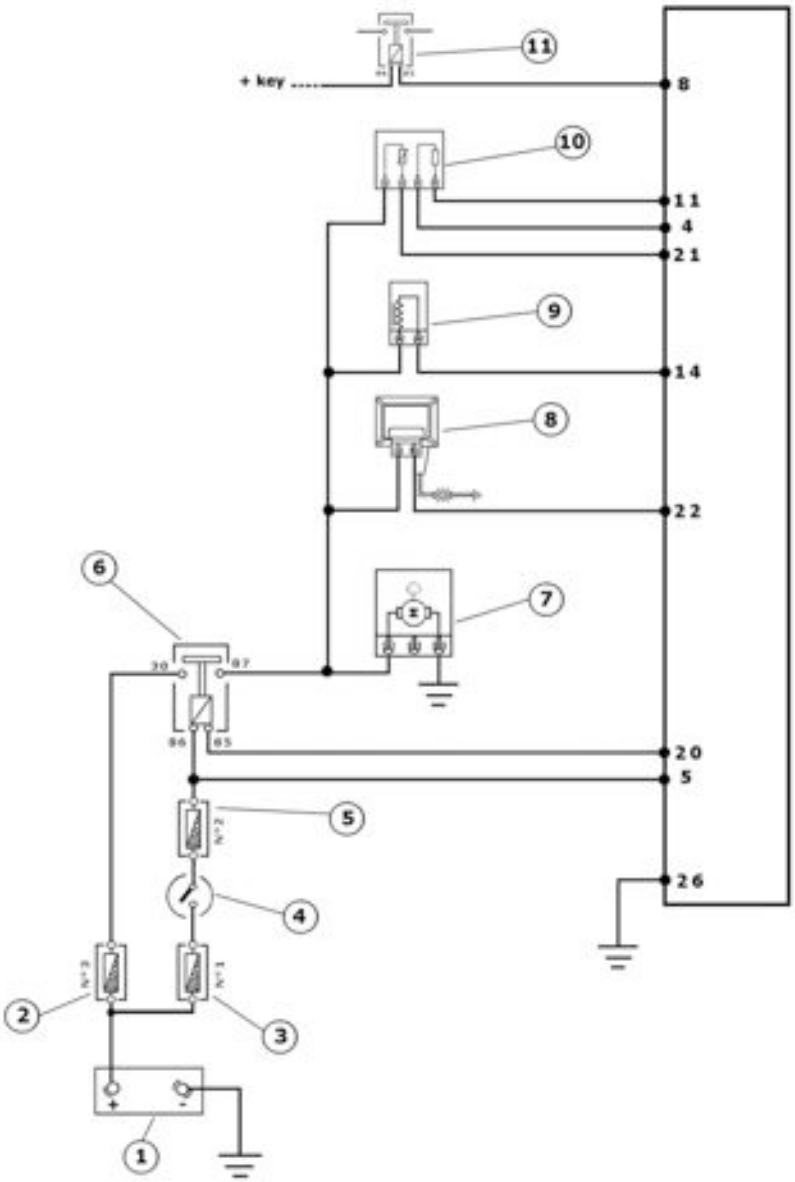
020481Y Control unit interface wiring

020331Y Digital multimeter



HT coil

Schema valido dal numero di telaio ZAPM4510000001579 in poi.

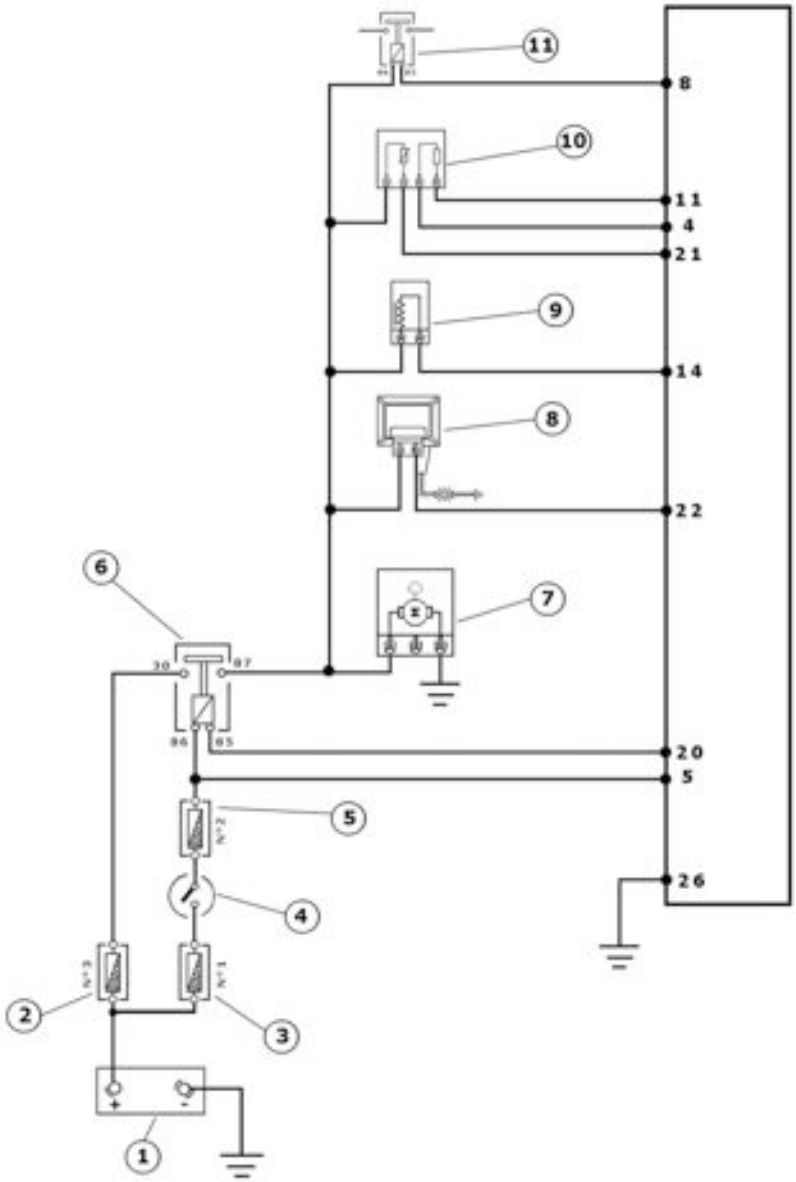


TEMPERATURE SENSOR 1

	Specification	Desc./Quantity
1	Battery	12 V - 12 Ah
2	Fuse	10A
3	Fuse	30 A
4	Key switch contacts	
5	Fuse	7.5 A
6	Injection load remote control	
7	Fuel pump	
8	H.V. coil	

	Specification	Desc./Quantity
9	Fuel injector	
10	Lambda probe	
11	Electric fan remote control switch	

Lo schema sottostante è valido per i telai dal numero ZAPM4510000001007 al ZAPM4510000001578. Per i telai successivi consultare la pagina 2.



TEMPERATURE SENSOR 1

	Specification	Desc./Quantity
1	Battery	12 V - 12 Ah
2	Fuse	10A

	Specification	Desc./Quantity
3	Fuse	30 A
4	Key switch contacts	
5	Fuse	7.5 A
6	Injection load remote control	
7	Fuel pump	
8	H.V. coil	
9	Fuel injector	
10	Lambda probe	
11	Electric fan remote control switch	

The ignition system combined with the injection is the high-efficiency induction type.

The control unit controls two important parameters:

- Ignition advance

This is optimised from moment to moment in accordance with the engine revs, engine load, temperature and environmental pressure.

With the engine at idle, it is optimised to obtain the stabilisation of the speed at 1450 ± 50 rpm's. - Magnetisation time

The coil magnetisation time is controlled by the central control unit. The power of the ignition is increased during the engine start-up phase.

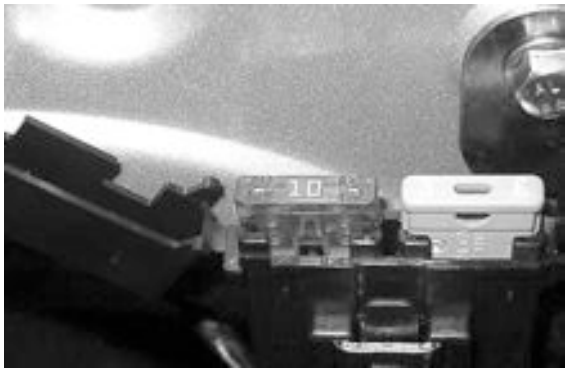
The injection system recognises the four-stroke cycle so the ignition is only commanded in the compression phase.

Specific tooling

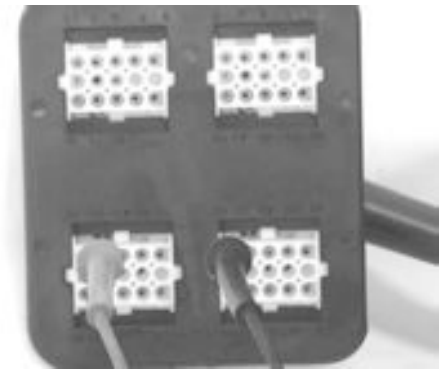
020331Y Digital multimeter

Check the integrity of the 10A injection loads fuse, no. 3.

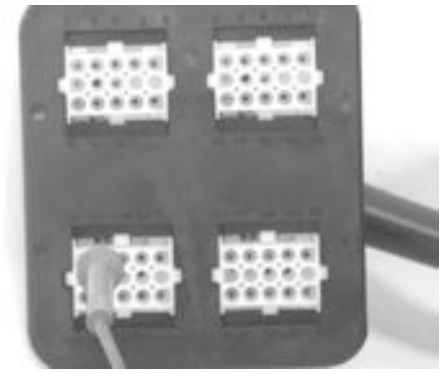
Check the integrity of the 7.5A ignition key-switch fuse, no. 2.



Check the presence of voltage between pins 22 and 26 of the interface wiring for around two seconds, switching to "ON"



Check the resistance of the primary coil between pin 22 of the interface wiring and the green black cable of the injection load remote control base with the control unit disconnected and the remote control disconnected.
Resistance of the primary = 0.5 ± 8% ohms



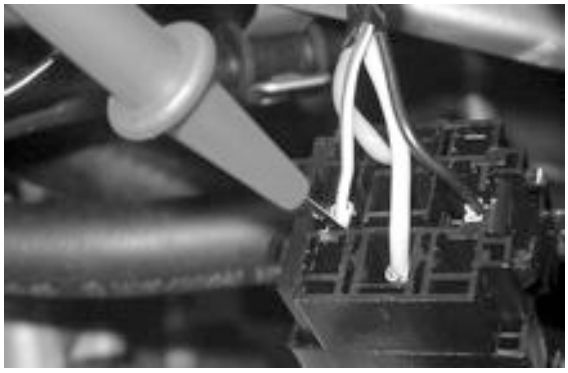
Check the efficiency of the injection load remote control: Check the resistance of the energising coil between pins 86 and 85: 40 to 80 Ohm
Apply a voltage of 12V to pins 86 and 85 and make sure that there is continuity between pins 30 and 87 of the remote control.

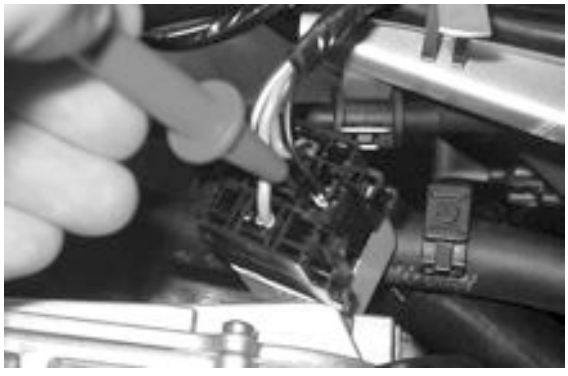
Check the wiring to the injection loads relay coil: turning the key-switch onto "ON", check for battery voltage, for 2 seconds, between the Red-

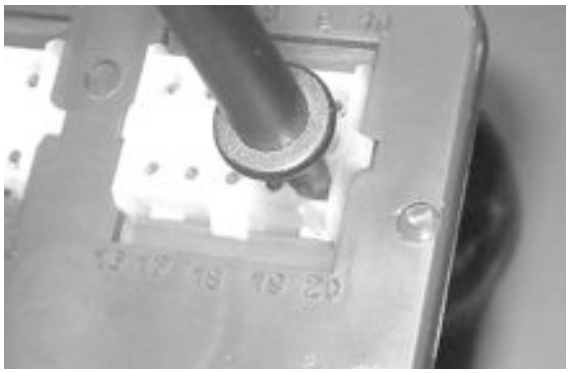
White and Black-Purple wires on the relay step. Otherwise, check for continuity, on the Red-White wire, between the fuse holder underneath the seat and the relay step, and on the Black-Purple wire, between pin 20, on the box, and the relay step.

N.B.

CONTINUITY TESTS MUST BE CARRIED OUT WITH THE COMPONENTS DISCONNECTED. (REMOTE CONTROLS, CONTROL UNIT, FUSES ETC.).



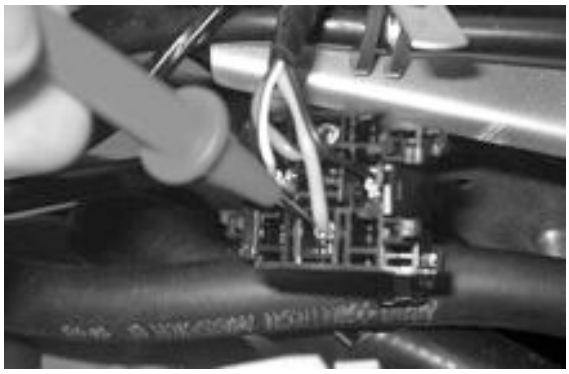


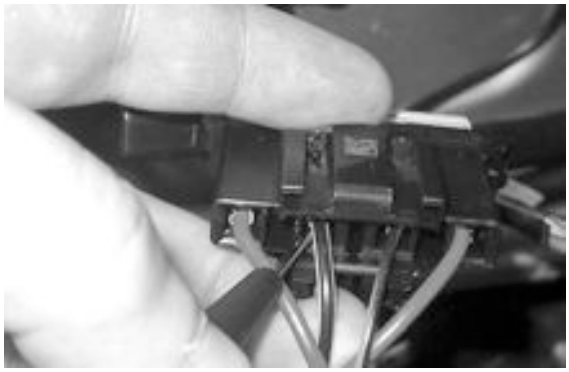


Check for the presence of DC voltage between the Grey-Black wire on the relay step and earth. Otherwise, check for continuity on the Grey-Black wire, between the fuse box (10A fuse no. 3) and the relay step.

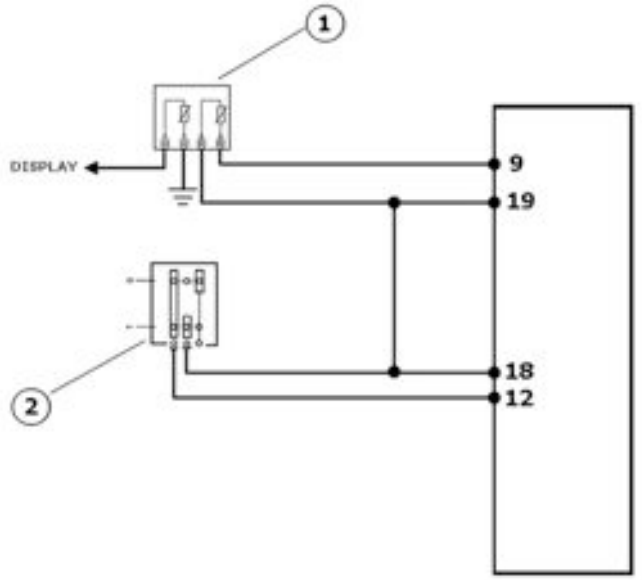
N.B.

CONTINUITY TESTS MUST BE CARRIED OUT WITH THE COMPONENTS DISCONNECTED. (REMOTE CONTROLS, CONTROL UNIT, FUSES ETC.).





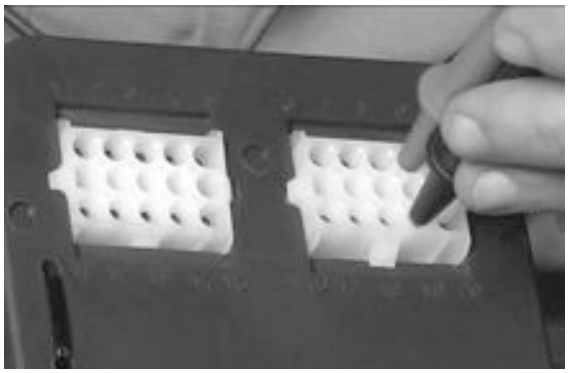
Coolant temperature sensor



TEMPERATURE SENSOR 1

	Specification	Desc./Quantity
1	Water temperature sensor	
2	Engine stop switch	

With the control unit side connector disconnected and the coolant temperature sensor connector connected, check the resistance between pins 9 and 19, correspond with the engine temperature.
20° = 2500 ± 100 Ω
80° = 308 ± 6 Ω
With the control unit side connector disconnected and the coolant temperature connector disconnected, check the insulation between the two light blue-green and grey-green cables



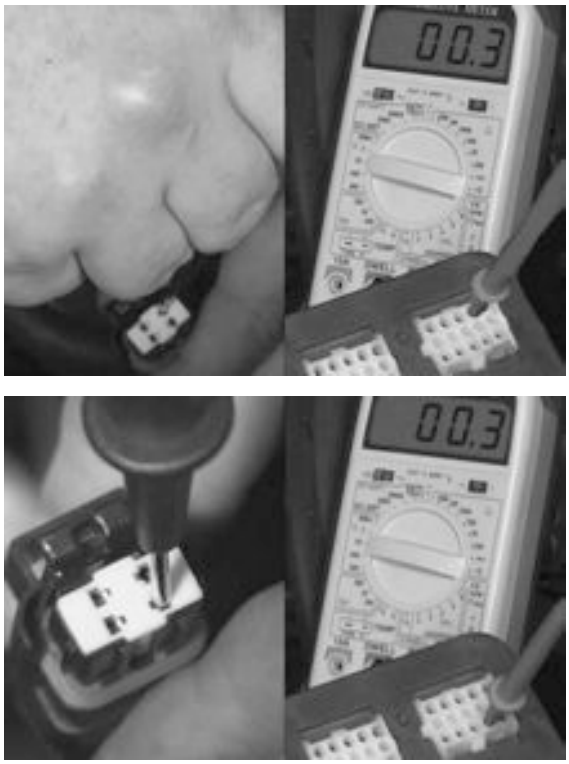
With the control unit side connector disconnected and coolant temperature sensor connector disconnected, check the continuity between pin 9 of the interface wiring and the light blue-green cable of the connector and between pin 19 of the interface wiring and the grey-green cable of the con-

nector.

Specific tooling

020481Y Control unit interface wiring

020331Y Digital multimeter



Zeroing the throttle

Resetting the throttle valve position signal (T.P.S. reset)

The MIU control unit is supplied with throttle valve position sensor and is pre-calibrated.

Pre-calibration entails regulating the minimum opening of the throttle valve to obtain a certain flow of air under preset reference conditions.

Pre-calibration ensures optimal air flow for the control of the idling.

This regulation must not be tampered with in any way whatsoever.

The injection system will complete the management of the idling through the stepper and the variation of the ignition advance.

The throttle body after the pre-calibration has an opened valve with angle that can vary depending on the tolerances of the machining of the pipe and the valve itself.

The valve position sensor can also assume various fitting positions. For these reasons the mVs of the sensor with the valve at minimum can vary from one throttle body to another.

To obtain the optimum fuel preparation, especially at small openings of the throttle valve, it is essential to match the throttle body with the control unit following the procedure known as TPS resetting.

With this operation we inform the control unit, as the starting point, of the mV value corresponding to the precalibrated position.

To reset, proceed as follows.

Connect the diagnostic tester.

Turn to "**ON**".

Select the functions of the diagnostic tester on "**TPS RESET**".

Specific tooling

020460Y Scooter diagnostics tester

-Check that the throttle valve has the control abutted against the abutment screw.

While maintaining this position, confirm the TPS reset procedure.

Resetting must be carried out in the following cases:

- on first fitting.

- if the injection control unit is replaced.

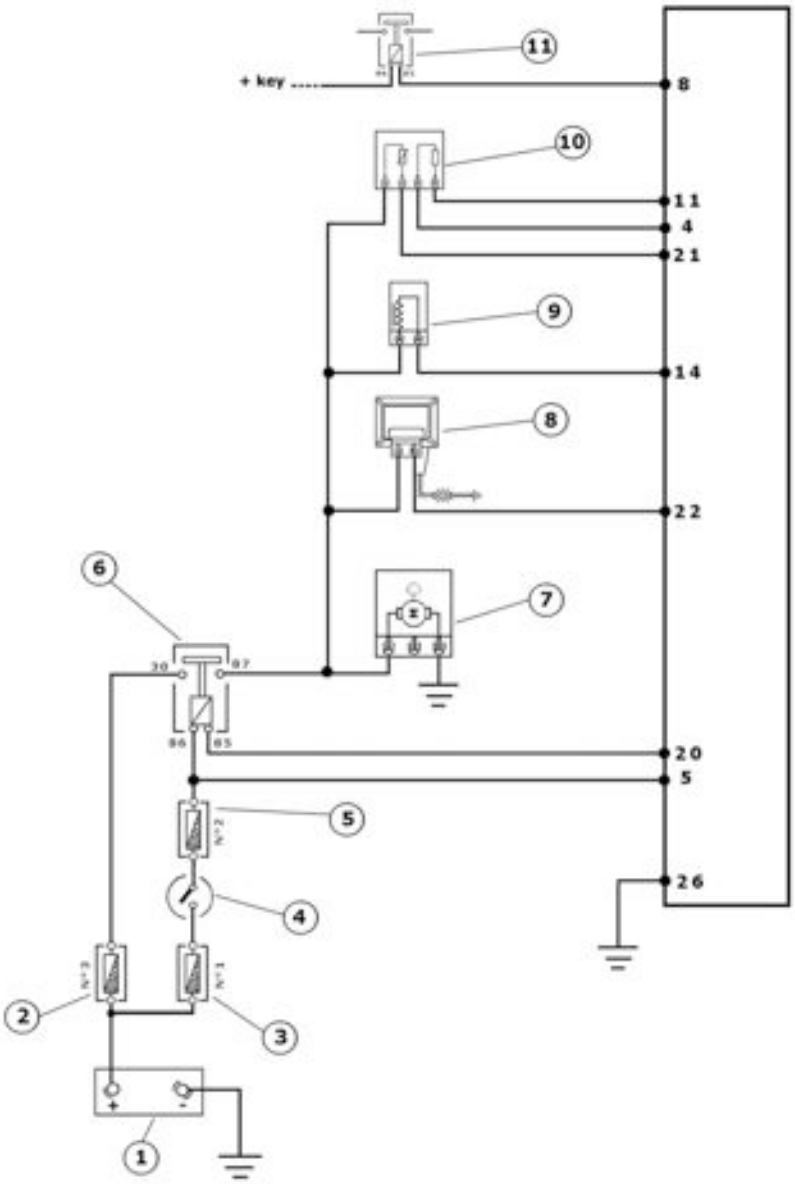
N.B.

THE TPS RESET PROCEDURE MUST NOT BE CARRIED OUT WITH OLD THROTTLE BODIES SINCE THE POSSIBLE VALVE AND ABUTMENT WEAR MAKE THE AIR FLOW RATE DIFFERENT FROM THAT OF PRE-CALIBRATION.

Given that the TPS resetting is also done when the control unit is replaced, place the control unit - filter box bellows at 45° during the refitting operation as shown in the photograph.

Lambda probe

Schema valido dal numero di telaio ZAPM4510000001579 in poi.



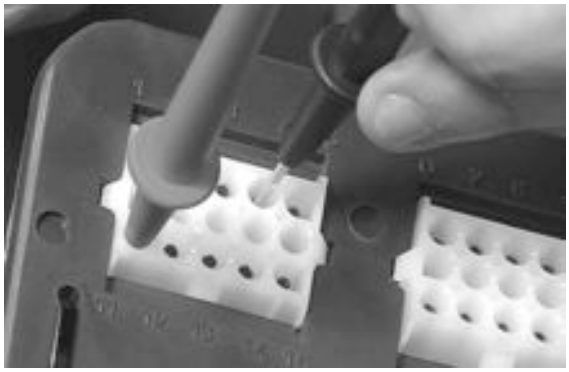
TEMPERATURE SENSOR 1

	Specification	Desc./Quantity
1	Battery	12 V - 12 Ah
2	Fuse	10A
3	Fuse	30 A
4	Key switch contacts	
5	Fuse	7.5 A
6	Injection load remote control	
7	Fuel pump	
8	H.V. coil	
9	Fuel injector	

	Specification	Desc./Quantity
10	Lambda probe	
11	Electric fan remote control switch	

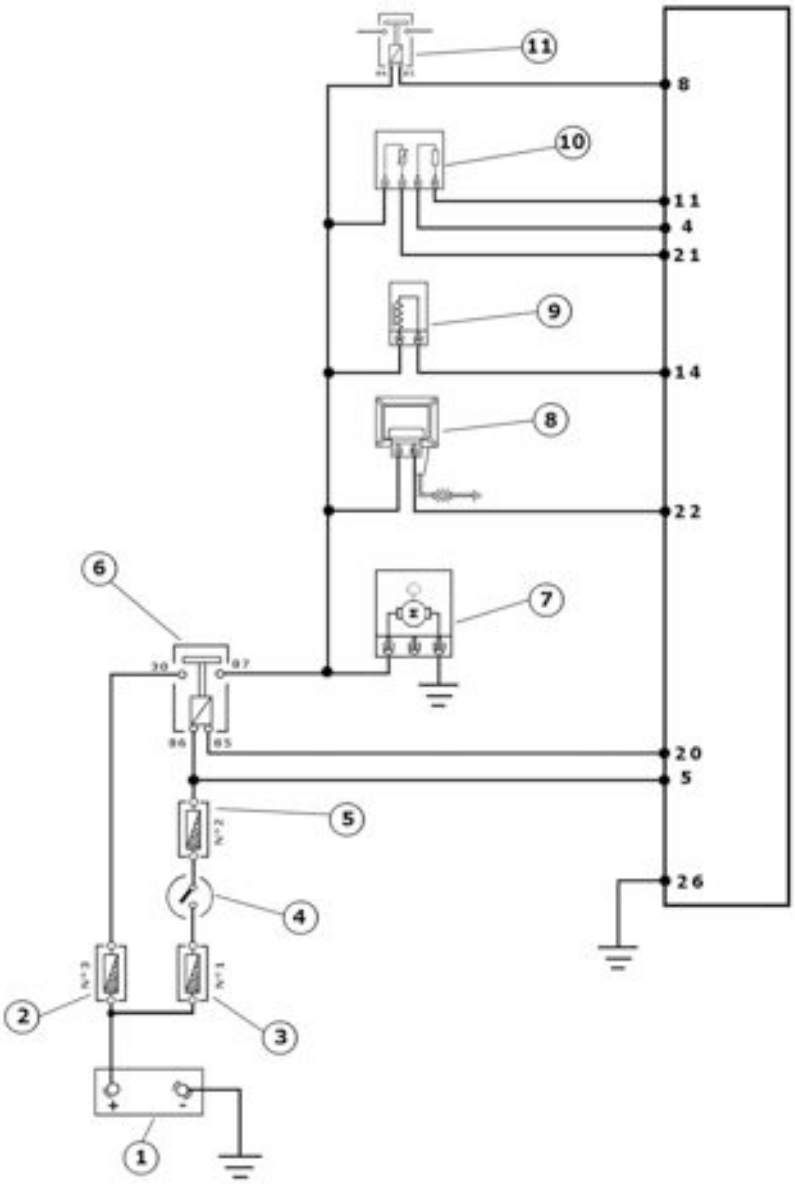
CONTROLLO DEL SEGNALE

Install the control unit interface wiring.
Start the engine and let it heat up until the electric fan cuts in.
Have an analogue multimeter with a continuous voltage reading and an end of scale of 2V at your disposal.
Place the tips of the multimeter between pins 4 (-) and 11 (+)



With the engine running at idle speed, check that the voltage oscillates between 0V and 1V
With the throttle valve completely open, the voltage is approx. 1V.
During the closing phase, the voltage is approx. 0V.
If the voltage remains constant, the sensor may be damaged. Remove the sensor and check that it has no deposits of oil or residues of carbon.

Lo schema sottostante è valido per i telai dal numero ZAPM4510000001007 al ZAPM4510000001578. Per i telai successivi consultare la pagina 2.



TEMPERATURE SENSOR 1

	Specification	Desc./Quantity
1	Battery	12 V - 12 Ah
2	Fuse	10A
3	Fuse	30 A
4	Key switch contacts	
5	Fuse	7.5 A
6	Injection load remote control	
7	Fuel pump	
8	H.V. coil	
9	Fuel injector	

	Specification	Desc./Quantity
10	Lambda probe	
11	Electric fan remote control switch	

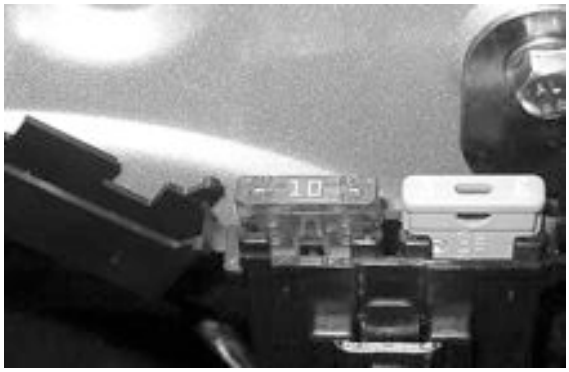
The Lambda probe or oxygen sensor is a sensor which provides indications concerning the oxygen content in the exhaust gas. The signal generated is not of the proportional type but of the ON/OFF type, i.e. there is oxygen or there is not. The sensor is positioned on the exhaust manifold before the catalytic converter in an area where the gas temperature is always high. The temperature at which the sensor works is at least 350°C at 600°C and it has a reaction time of just 50 milliseconds. The signal generated passes from a high value to a low value with a mixture with lambda =1. Since the sensor only works at high temperatures, it has an electric preheating element inside it, controlled by the control unit, to take it quickly to the functioning state. .

Specific tooling

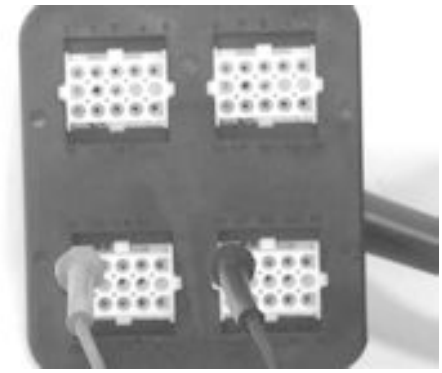
020481Y Control unit interface wiring

020331Y Digital multimeter

Check the integrity of the 10A injection loads fuse, no. 3.
Check the integrity of the 7.5A ignition key-switch fuse, no. 2.

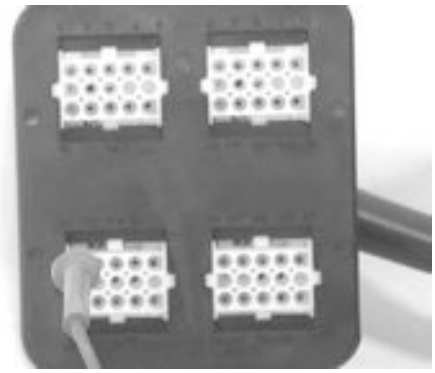


Check the presence of voltage between pins 21 and 26 of the interface wiring for around two seconds, switching to "ON"

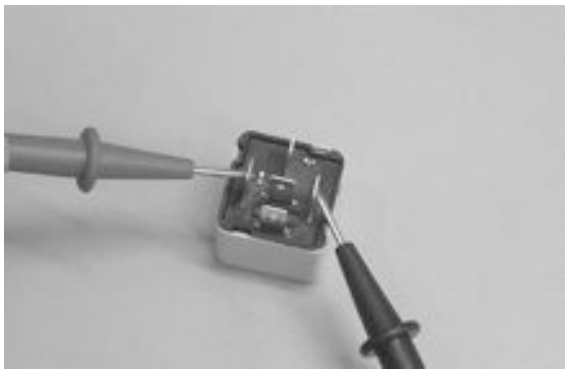


With the engine cold, check the resistance of the Lambda probe heater between pin 21 of the interface wiring and the green black cable of the injec-

tion load remote control base with the control unit disconnected and the remote control disconnected.
Resistance of the heater at approximately 20° = 9 ohms ± 20%



Check the efficiency of the injection load remote control: Check the resistance of the energising coil between pins 86 and 85: 40 to 80 Ohm
Apply a voltage of 12V to pins 86 and 85 and make sure that there is continuity between pins 30 and 87 of the remote control.

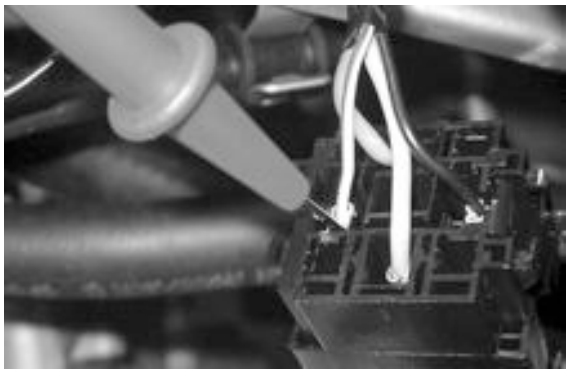


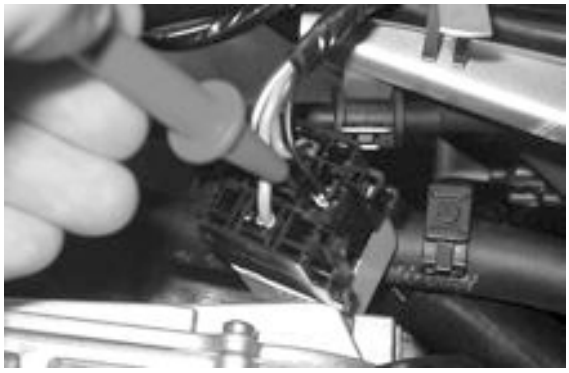
Check the wiring to the injection loads relay coil: turning the key-switch onto "ON", check for battery voltage, for 2 seconds, between the Red-White and Black-Purple wires on the relay step. Otherwise, check for continuity, on the Red-White wire, between the fuse holder underneath the seat and the relay step, and on the Black-Purple wire, between pin 20, on the box, and the relay step.

N.B.

CONTINUITY TESTS MUST BE CARRIED OUT WITH THE COMPONENTS DISCONNECTED. (REMOTE

CONTROLS, CONTROL UNIT, FUSES ETC.).



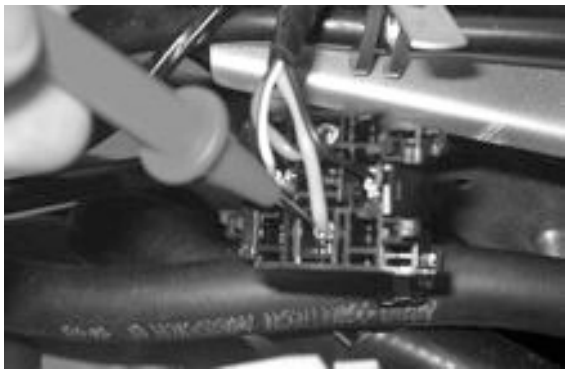


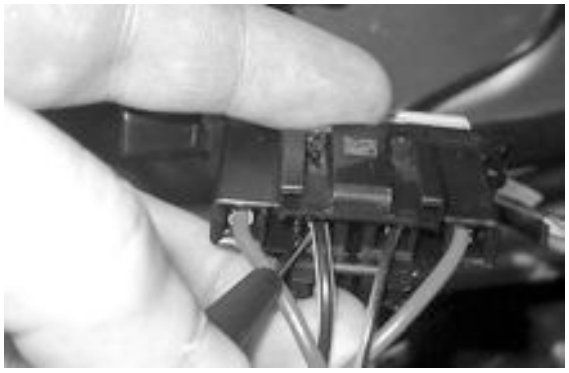
Check for the presence of DC voltage between the Grey-Black wire on the relay step and earth. Otherwise, check for continuity on the Grey-Black wire, between the fuse box (10A fuse no. 3) and

the relay step.

N.B.

CONTINUITY TESTS MUST BE CARRIED OUT WITH THE COMPONENTS DISCONNECTED. (REMOTE CONTROLS, CONTROL UNIT, FUSES ETC.).





INDEX OF TOPICS

SUSPENSIONS	SUSP

This section provides information on the operations that may be carried out on the suspensions.

Front

Removing the front wheel

- Remove the 5 fixing screws shown in the figure.

Locking torques (N*m)

Wheel fixing screws 20 ÷ 25

Front wheel hub overhaul

- Remove the ball bearing lock snap ring shown in the figure

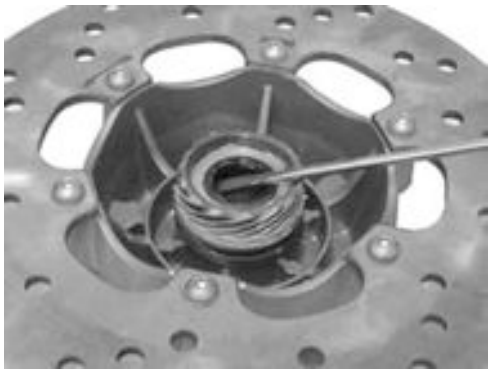
Using the specific tool, remove the ball bearing.

Specific tooling

001467Y014 Puller for removing 15 mm bearings

001467Y017 Bell for bearings outer diam. 39 mm

- Using a screwdriver, remove the oil guard on the roller bearing side.



Using the specific tool, remove the roller bearing

Specific tooling

020376Y Handle for adaptors

020456Y Diameter 24 mm adaptor

020363Y 20mm guide

- Using a thermal gun, warm the roller bearing seat
- Using the specific tool, insert the bearing with the screened side facing outwards and move it to travel end
- Replace the ball bearing lock snap ring

Specific tooling

020151Y Air heater

020376Y Handle for adaptors

020359Y 42 x 47 mm adaptor

020412Y 15 mm guide

- Using the specific tool, insert the roller case and move it to travel end
- Replace the oil guard on the roller bearing side
- Apply grease between ball and roller bearings

Specific tooling

020038y Drift

Recommended products

JOTA 3 FS Driving gear odometer case grease

NLGI 3 lithium soap grease

Refitting the front wheel

- Upon refitting, follow the removal operations in reverse, complying with the tightening torque.

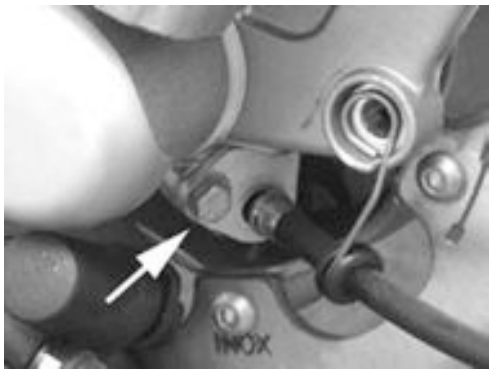
Locking torques (N*m)

Wheel fixing screws 20 ÷ 25 Wheel axle nut 74 ÷ 88

Steering column

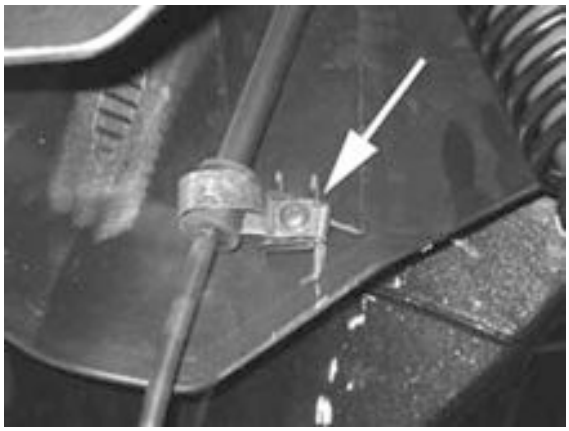
Removal

- Remove the front wheel
- Remove the brake calliper
- Loosen the screw fixing the mounting plate for the odometer cable and remove the cable itself.



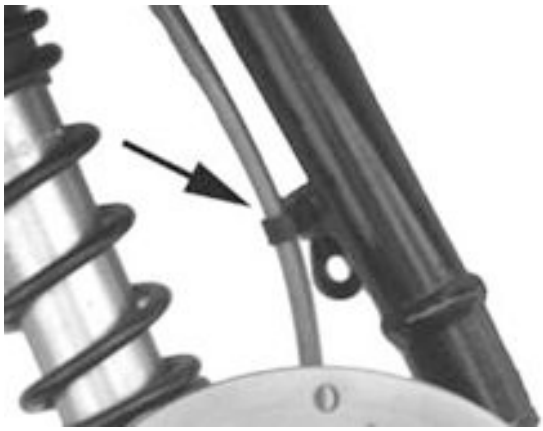
- Remove the suspension arm cover by loosening the three screws shown in the figure.

- Remove the odometer cable mounting from the fender as shown in the figure.

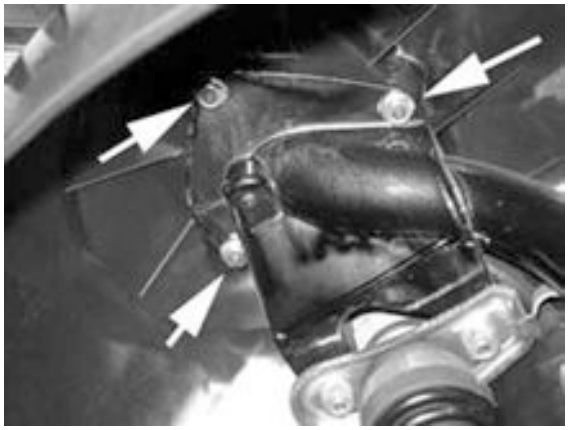


- Remove the brake hose fixing plate from the top plate on the front shock-absorber

- Remove the brake hose fixing from the suspension arm



- Loosen the 3 nuts fixing the fender to the suspension



- Remove the rear handlebar cover
- Remove the screw fixing the handlebar to the steering column
- Flip the handlebar onto the knee-guard paying attention not to scratch the plastics

- Remove the cap from the steering column ring-nut

- Using the special tool, remove the counter-ring nut, spacing washer and upper steering bearing seat
- Remove the steering column and the fender from the suspension

Specific tooling

020055Y Key for steering column ring-nut

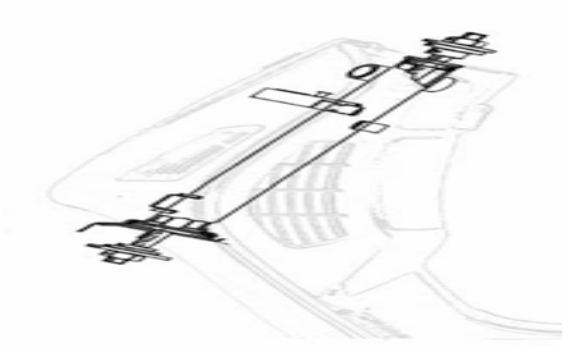
Overhaul

This operation should be carried out only if really needed and in any case, replacing the old parts removed with new parts.

- Remove the steering tube
- Using the specific tool, remove the top fifth wheel seat on the steering head from the bottom of the latter, as shown in the figure. Then, work from the top to remove the bottom fifth wheel seat

Specific tooling

020004Y Puller for removing the fifth wheel from the headstock



- Using the specific tool, remove the fifth wheel seat and the dust guard on the steering tube as shown in the figure. Proceed by slightly hitting with a mallet.

Specific tooling

020004Y Puller for removing the fifth wheel from the headstock

- Using the specific tool, replace the dust guard and the fifth wheel seat on the steering tube to abutment.

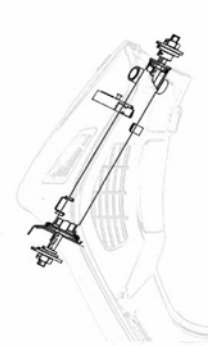
Specific tooling

006029Y Punch for fitting the seat of the fifth wheel on the steering column

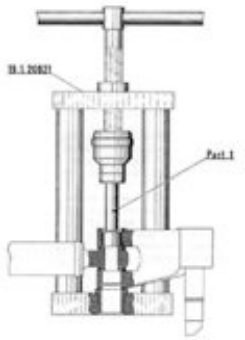
- Using the specific tool fit the steering tube on the steering head as shown in the figure

Specific tooling

001330Y Tool for fitting steering seats



- Remove the steering tube
- Remove the shock absorber-caliper coupling bracket
- Apply the specific tool provided with part 1 and move the handle to obtain the concurrent ejection of the pin and of the Nadella opposed to the tool thrusting action.
- To eject the second Nadella, use the tool provided with part 2 in replacement of part 1, on the side opposed that shown in the figure.



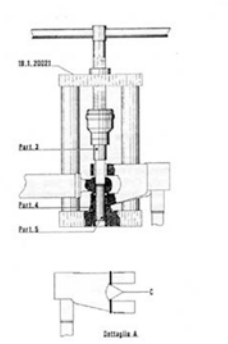
Specific tooling

020021Y Front suspension overhaul tool

- Install the two dust guard rings «**C**» on the oscillating hub as shown in detail «**A**».
- Connect the oscillating hub to the steering tube by the guiding pin part 5.
- Apply the specific tool provided with part 3 onto

the stem, and with part 4, on the tool base.

- Insert the pin, greased beforehand with grease, on the oscillating hub and move the tool handle to move part 3 in abutment on the steering tube.
- After having installed the pin, introduce the two spacers part 17 using a mallet (see next figure).



CAUTION

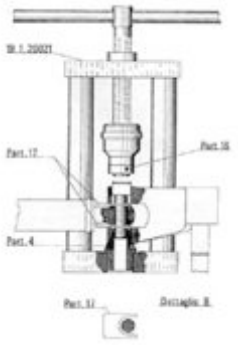
REASSEMBLE WITH NEW ROLLER BEARINGS, PIN, OIL SEALS AND DUST SEALS.

Specific tooling

020021Y Front suspension overhaul tool

To assemble sealing rings, roller cases and wedging washers, proceed as follows

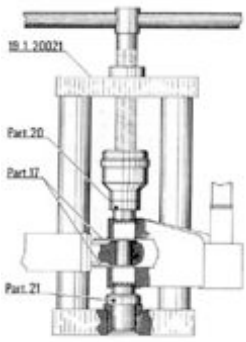
- Lubricate the sealing rings with mineral oil and half fill the roller cases with grease.
- Introduce the sealing ring on the pin and at the same time, the roller bushing with wedging washer.
- Remove the specific tool, then part 5 (guide) partly ejected in the previous assembly step; let part 4 on.
- On the stem, replace part 3 with part 16.
- Push the handle to push the wedging washer - sealing ring assembly to move part 16 in abutment with the oscillating hub.
- Repeat the operation described above using the tool provided on the stem with part 16 and with part 22* in replacement of part 4, on the side opposed to that shown in the figure to reassemble the second wedging washer - roller case - sealing ring assembly.



To position the roller case on the pin (the pin end in contact with the inside bottom of the roller

case) proceed as follows:

- Use the tool provided with part 20 and part 21 on the stem, as shown in the figure.
- Push the handle to move the bottom of the two roller cases in contact with the pin end.



Refitting

Upon refitting, follow the same steps carried out for the removal operations in the reverse order, lubricate the ball bearing seats with grease and observe the tightening torques

Locking torques (N*m)

Handlebar to steering column 45 ÷ 50 Nm Steering upper ring nut 35 ÷ 40 Steering lower ring nut 12 ÷ 14

Front shock absorber

Removal

- Remove the steering tube
- Remove the shock absorber bottom fixing screws
- Remove the top shock absorber attachments

Refitting

- For re-assembly, perform the operations for removal in the reverse order according to the tightening torques.

Locking torques (N*m)

Shock absorber top fixing 20 - 27 Nm Shock absorber bottom fixing 20 - 30 Nm

Shock-absorber - calliper bracket

- Remove the wheel hub with the brake disc
- Remove the front shock absorber bottom fixing screws

- Remove the bracket lock snap ring
- Extract the bracket

- Before replacing the bracket into the wheel axle, place the o-ring as shown in the figure in order to have a proper positioning of the same after the installation of the bracket.
- Replace the washer and the snap ring
- Replace the screws fixing the shock absorber to the bracket and tighten at the prescribed torque

Locking torques (N*m)

Shock absorber bottom fixing 20 ÷ 27 Nm

Overhaul

- The caliper - shock absorber fixing bracket is provided with two roller bearings spaced from one another as shown in the figure

- Remove the two roller bearings from the bracket using the specific tool from the shock absorber coupling side, as shown in the figure

Specific tooling

020376Y Handle for adaptors

020441y 26 x 28 mm adapter

020365y 22 mm guide

- Remove the oil guard on the wheel hub side using a screwdriver as shown in the figure

- Suitably support the shock absorber - brake caliper bracket
- Using the specific tool, install a new oil guard and move it to travel end

Specific tooling

020376Y Handle for adaptors

020360Y 52 x 55 mm adaptor

- Using the specific tool, install a new roller bearing on the shock absorber side and move it to travel end

Specific tooling

020036y Drift

- Suitably support the shock absorber - brake caliper bracket
- Using the specific tool, install a new oil guard and move it to travel end

Specific tooling

020037y Drift

Rear

Removing the rear wheel

- Remove the rear shock absorber - silencer support bracket
- Release the 5 screws shown in the figure to remove the rear wheel

Refitting the rear wheel

For re-assembly, perform the operations for removal in the reverse order according to the prescribed torques.

Locking torques (N*m)

Wheel fixing screws: 20÷25 Nm

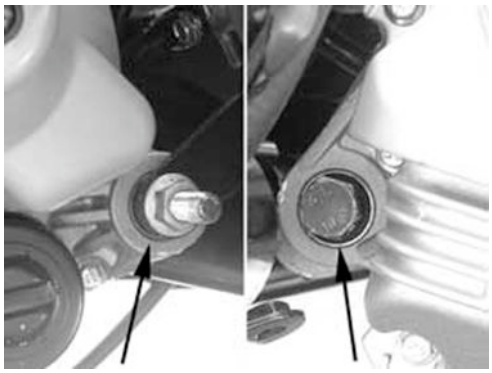
Swing-arm

Removal

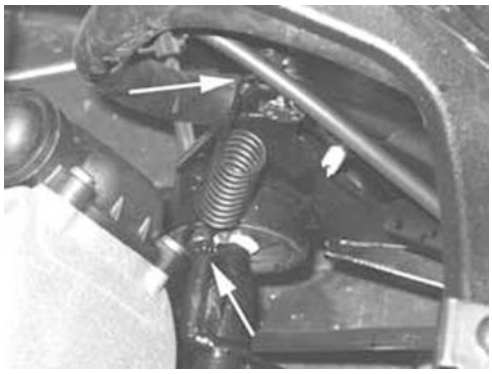
- Rest the vehicle on the central stand;
- Remove the air cleaner box.
- Remove the screw fixing the oscillating arm to

the engine as shown in the figure

- Retract the engine



- remove the spring anchoring the swinging arm to the frame as shown in the photo



- Remove the two screws fixing the buffer support bracket to the frame

- Remove the right and left caps located under the footboard to access the pin fixing the oscillating arm to the body.
- Remove the pin. Then, remove the oscillating arm.

- Check the entire swinging arm assembly.
- Check all the centring bushing components and silent block rubber buffers.
- Replace the work components that cause excessive clearance on the rear suspension.

Overhaul

- Check there is no sticking in the movement of the connection of the swinging arm on the engine side to the swinging arm on the frame side.
- Check the axial clearance between the two swinging arms using a feeler gauge

Characteristic

Standard clearance

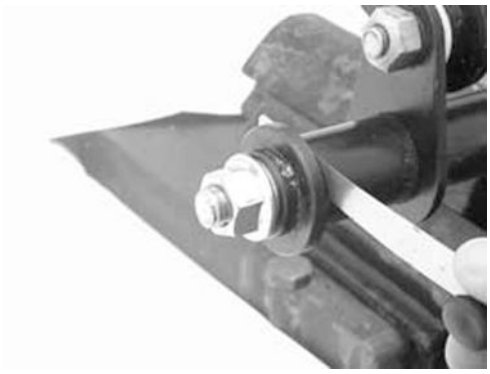
0.40 ÷ 0.60 mm

Allowable limit after use:

1.5 mm

- To check the clearance on the frame side arm, mount the fitting using the pin fixing the swinging arm to the frame and two adaptor rings of the appropriate tool 020229Y. Alternatively use two washers with inner diameter for 12 mm pins , min. outer diameter 30 mm and shim at least 4 mm.

- Check there is no sticking in the rotation.
- Check the axial clearance of the swinging arm on the frame side



Characteristic

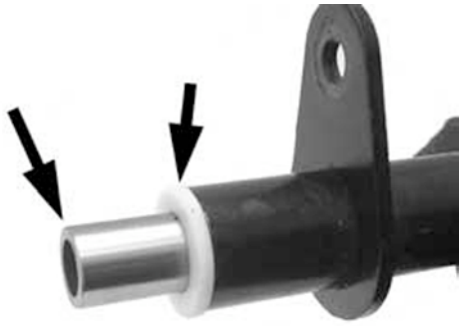
Standard clearance

0.40 ÷ 0.60 mm

Allowable limit after use:

1.5 mm

- Separate the swinging arm on the engine side from the vehicle side arm.
- Remove the plastic bushings and the internal spacer shown in the photo.



- Using a suitable pin remove the roller casings as shown in the photographs

- Using an appropriate tool plant new roller casings, being careful to position the bearings with

the O-rings facing outwards

Specific tooling

020244Y 15 mm diameter punch

020115Y Diameter 18 punch

Characteristic

Length of the swinging arm tube on the engine side:

L 175.3 + 0.3 0

Length of the internal swinging arm spacer on the engine side:

L 183 + 0,3 0

Engine side swinging arm plastic bushing shim:

3.5 ± 0.05 mm

Frame side swinging arm plastic bushing shim:

3.5 ± 0.05 mm

Length of the internal swinging arm spacer on the frame side:

290 ± 0.1 mm

Length of the swinging arm tube on the frame side:

283 ± 0.1 mm

- Lubricate roller casings and the plastic bushings with grease
- Insert the spacers
- Assemble the two arms with the relative bolt in the position shown in the photograph
- Adjust the bolt as shown in the photograph
- Position the frame side swinging arm with the most protruding part pointing towards the silent block side as shown in the photograph

Recommended products

TUTELA ZETA 2 Grease for the steering bearing, pin seat and swinging arm

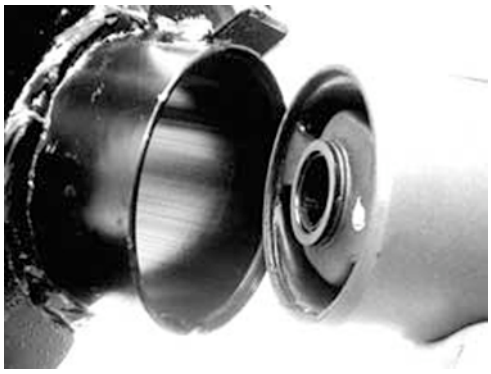
NLG12 lithium soap and zinc oxide swinging arm grease

- Make sure the silent bloc is not broken. If it is, replace it.
- Remove the seeger ring shown in the photograph

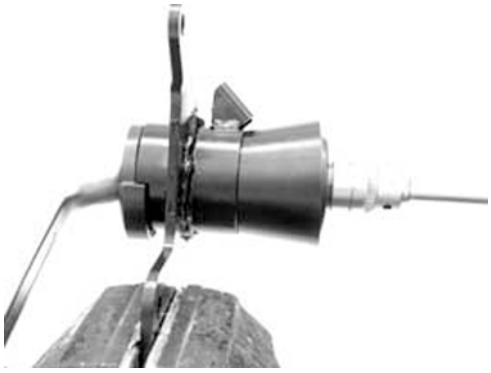
- Remove the full silent bloc bracket
- Undo the silent bloc ring shown in the photograph

- Hold the full silent bloc bracket in the clamp
- Using the appropriate tool, remove the silent bloc from the bracket from the side corresponding to the inside of the vehicle . This is to guarantee the tool is centred properly on the support

- Install a new silent bloc, making sure it aligns properly with the reference tooth.
- Fit the silent blocs, making sure the chamfered part of the silent bloc matches the chamfered part of the bracket



- Using the appropriate tool, fit the silent bloc as indicated in the photo



Refitting

- To refit, perform the removal operations in reverse.
- Grease the bearings and the rolling parts with the recommended grease.
-Complete the fitting by tightening the nuts on the relative bolts to the proper tightening torque.

Locking torques (N*m)

Engine and vehicle side swinging arm junction pin 33 ÷ 41 Nm Swinging arm pin - Engine 64 ÷ 72 Body shell - Swinging arm pin: 76 ÷ 83 Nm Screw fixing the silent-block support plate to the body 42 ÷ 52 Nm

Shock absorbers

Removal

Proceed as follows:

- Rest the vehicle on the central stand;
- Remove the trunk rack
- Slightly raise the engine by a jack to free both shock absorbers;
- Remove the silencer;
- Loosen the shock absorber spring unit fastening screw from the support fixed to the engine and from that fixed to the silencer support;
- Loosen the two top nuts (one by side) fixing the shock absorber spring unit to the chassis and remove the shock absorbers.

Refitting

Perform the operations for removal in the reverse order according to the proper tightening torques.

Locking torques (N*m)

Lower shock absorber clamping screw 33 ÷ 41 Nm Shock absorber top fastening screw 20 ÷ 25 Nm

Exhaust bracket

Removal

- Remove the silencer
- Remove the two screws fixing the bracket to the engine crankcase
- Remove the split pin, the key cap and the rear wheel axle fixing nut with the spacer
- Remove the bottom shock absorber fixing

Refitting

- For re-assembly, perform the operations for removal in the reverse order according to the tightening torque

Locking torques (N*m)

Screw fixing the bracket to the engine crankcase: 20 ÷ 25 Nm Shock absorber bottom mounting 33 - 41 Wheel axle nut 104 ÷ 126 Nm

Centre-stand

REMOVAL

- Use a jack to support the vehicle properly.
- Remove the two return springs from the centre stand.
- Undo the nut shown in the figure.
- Remove the bolt from the right side.
- Remove the centre stand.

FITTING

- On refitting tighten the nut to the specified torque.

Locking torques (N*m)

Centre-stand bolt 32 ÷ 40

Side stand

REMOVAL

- Uncouple the centre stand return spring;

Remove the screw shown in the photograph

FITTING

To refit, carry out the removal operations in reverse order and comply with the specified torque.

Locking torques (N*m)

Side stand fixing bolt 35 ÷ 40

INDEX OF TOPICS

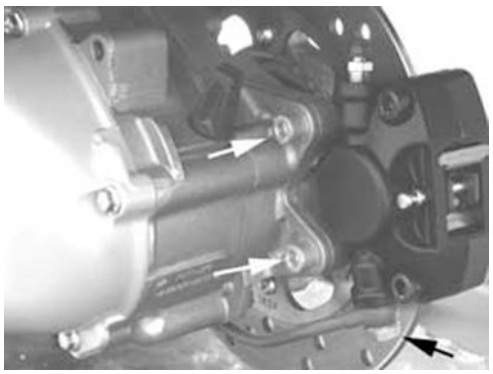
BRAKING SYSTEM	BRAK SYS

This section è devoted to the description of the brake system components.

Rear brake calliper

Removal

- Remove the rear wheel.
- Remove the pad retention pin.
- Using a pin partially remove the brake pad retention pin.
- Remove the screws fixing the brake calliper to the crankcase then remove the brake calliper complete with pipe.
- Complete the extraction of the pad retention pin, the spring and the pads.



N.B.

IF IT IS NECESSARY TO REPLACE OR SERVICE THE BRAKE CALLIPER, BEFORE REMOVING THE FITTINGS FIXING THE CALLIPER TO THE SUPPORT BRACKET, FIRST LOOSEN THE OIL HOSE FITTING AFTER HAVING EMPTIED THE SYSTEM OF THE CIRCUIT BEING EXAMINED.

Overhaul

- Remove the rear brake calliper.
- Suitably hold the brake calliper in a clamp
- Remove the two calliper coupling screws as shown in the photo
- Remove the two pistons from the calliper body with the aid of short blasts of compressed air through the brake fluid holes
- Remove the dust ring and the O-ring of each half calliper.
- Remove the O-rings in the half calliper.

N.B.

DO NOT SCRATCH THE HALF-CALLIPER SEATS

WHILE REMOVING THE RINGS.

- Check there is no scoring in the pistons and in their seats.
- Wash and blow all the components carefully
- Fit the O-rings and new dust guards
- Refit the pistons in their seats being careful to lubricate with brake fluid
- Recouple the half callipers and lock the two screws at the specified torque

Locking torques (N*m)

Calliper coupling screw 30 ÷ 33 Nm

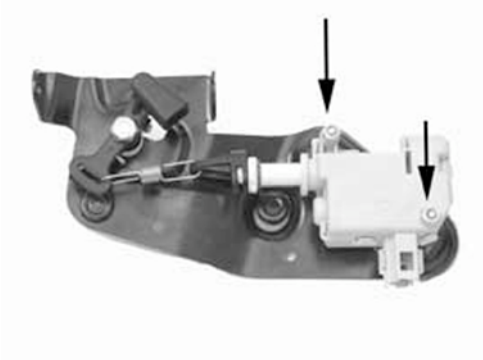
Refitting

- Insert the brake pads in the calliper.
- Insert the pad fixing pin and the retention screw being careful to position the terminals of it pointing towards the bleed screw as shown in the photo.
- Insert the clip on the pad fixing pin

N.B.

A WRONG POSITIONING OF THE PADS ACCORDING TO THE DIRECTION OF ROTATION CAN IMPAIR THE BRAKE PERFORMANCE AND NOISE-

- Remove the two screws shown in the figure
- Remove the peg from the transmission
- Remove the actuator from the support bracket

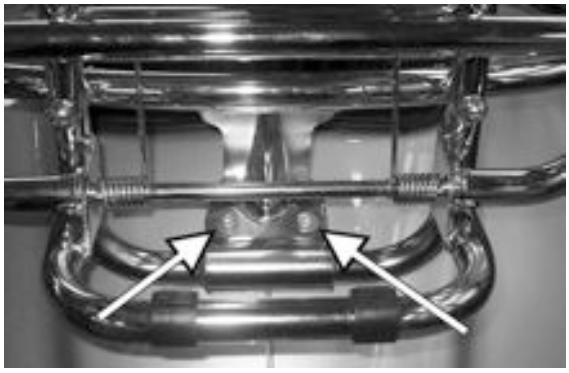


- Remove the helmet compartment
- Remove the two screws shown in the figure
- Remove the saddle

Rear rack

- Remove the helmet bay
- Remove the 4 screws shown in the figure

- Remove the two screws fixing the luggage rack to the chassis, as shown in the figure



Rear handlebar cover

- Remove the front handlebar cover
- Loosen the 5 screws shown in the figure
- Detach the odometer cable
- Remove the rear handlebar cover after detaching the electrical wires.

Instrument panel

- Remove the rear handlebar cover;
- Remove the four screws shown in the figure
- Remove the instrument unit.

Front handlebar cover

- Remove the front radiator grill
- Remove the front screw shown in the figure

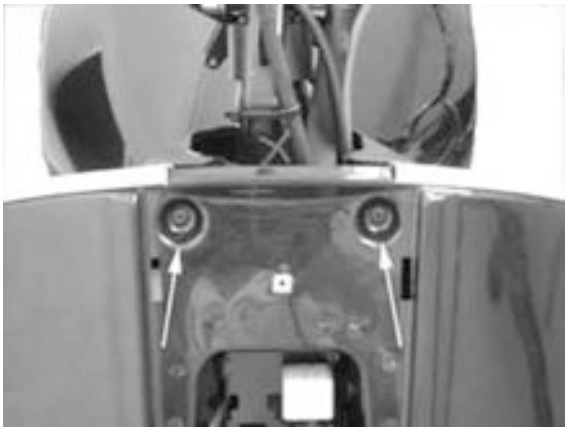
- Loosen the 2 screws shown in the figure;
- Remove the front handlebar cover.
- Disconnect the front headlight connectors

Headlight assy.

- Release the screw shown in the figure to remove the rear direction indicator

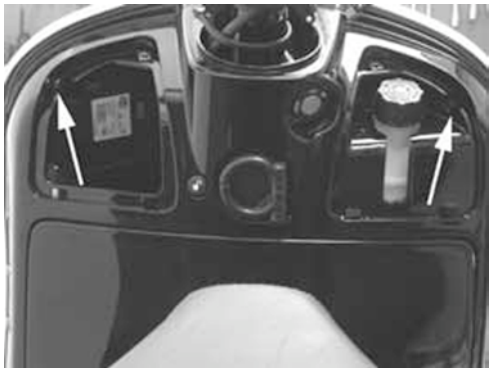
Knee-guard

- Remove the rear handlebar cover
- Remove the two screws onto the shield below the radiator grill, as shown in the figure

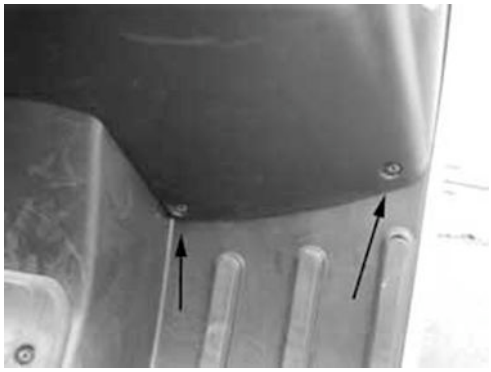


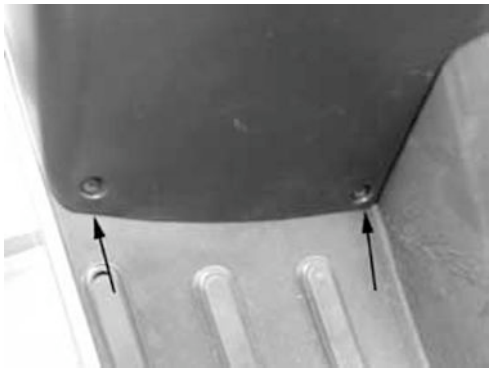
- Remove the expansion tank cover and remove the expansion tank cap
- Remove the central screw inside the trunk as shown in the figure

- Remove the two screws shown in the figure and respectively located under the expansion tank cover and under the left cover



- Remove the bottom counter-shield screws on both the right and left of the counter-shield, as shown in the figure





- Remove the electric saddle opening button wiring, the fuse holder box and the manual saddle opening cable as shown in the figure

Taillight assy.

- Release the screw shown in the figure to re-

move the rear direction indicator

To remove the taillight, remove the screw, «**A**».
This provides access to the taillight, stop and license plate light bulbs.
Upon refitting, repeat these operations backwards.

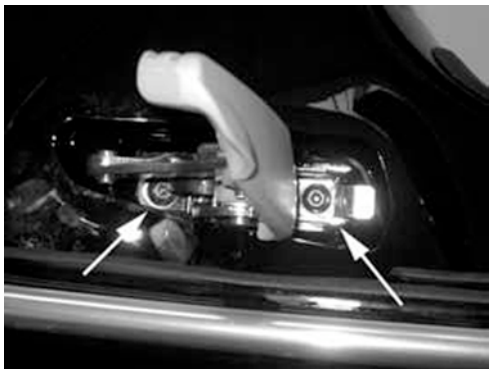
WARNING

SHOULD MIST BE SEEN TO HAVE FORMED ON THE INSIDE SURFACE OF THE LIGHT, THIS DOES NOT MEAN THERE IS A FAULT, BUT RATHER IS A RESULT OF THE LEVEL OF HUMIDITY AND/OR LOW TEMPERATURE. THE PHENOMENON SHOULD QUICKLY DISAPPEAR WHEN THE LIGHT IS SWITCHED ON. THE PRESENCE OF DROPS OF WATER, ON THE OTHER HAND, COULD INDICATE THAT WATER IS INFILTRATING. CONTACT THE PIAGGIO AFTER-SALES SERVICE NETWORK.

Footrest

- Remove the counter-shield
- Remove the battery compartment cover
- Remove the sides
- Remove the central screw located under the battery compartment cover as shown in the figure

- Remove the passenger footboards by the two screws shown in the figure



- Remove the left and right side footboard fixing screw shown in the figure

- Remove the left and right bottom covers as shown in the figure

- Remove the screws located under the non-slip rubber of the footboard as shown in the figure

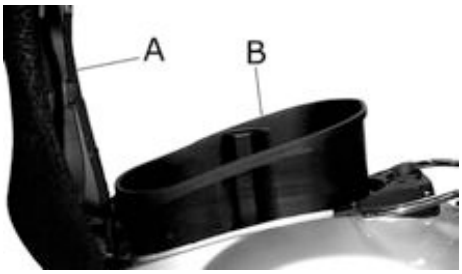
Side fairings

Loosen fixing screw "A"

Loosen nut "B" located underneath the chassis

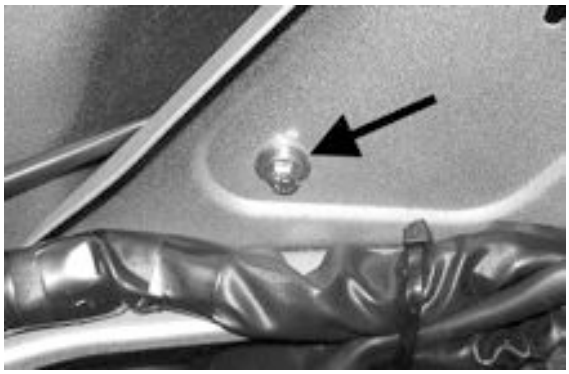
Helmet bay

- Raise the saddle and remove the helmet compartment



Fuel tank

- Remove the helmet bay
- Remove the side fairings
- Remove the exhaust
- Remove the rear luggage rack
- Remove the top shock-absorber fixings
- Remove the two screws, shown in the figure, fixing the fuel tank to the chassis.



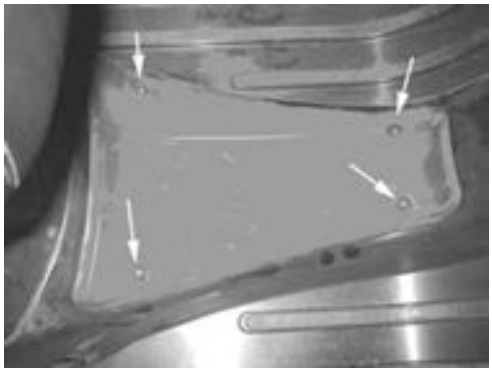
- After removing the taillight, loosen the screw, shown in the figure, fixing the fuel tank to the chassis.

- Remove the two turn signal lights
- Using a jack, lift the chassis until there is

enough gap, between the rear-end of the vehicle and the engine, to slip the fuel tank.
Upon refitting, follow these operations in the reverse order.

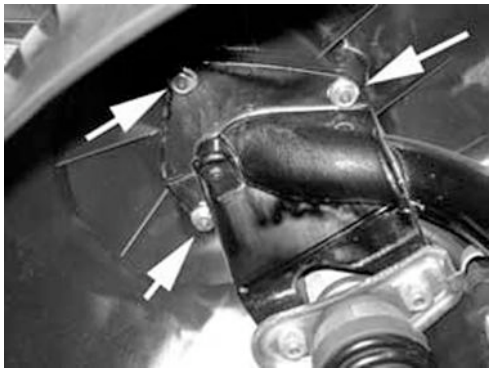
Rear central cover

- Remove the four screws shown in the figure



Front mudguard

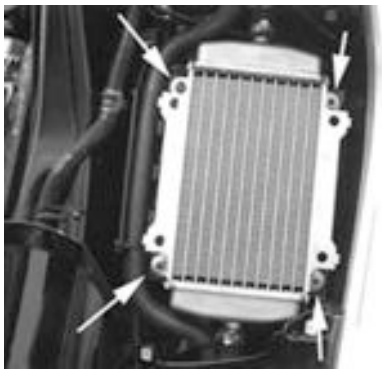
- To remove the front mudguard, remove the steering tube and release the front brake piping from the caliper
- Then, remove the three attachments fixing the mudguard to the steering tube as shown in the figure



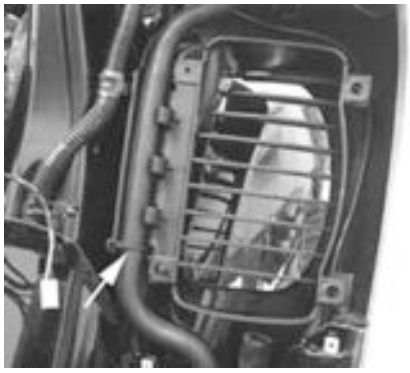
Radiator fan

- To perform the operations on the radiator unit we recommend draining the cooling fluid from the fluid inlet piping into the pump shown in the figure.

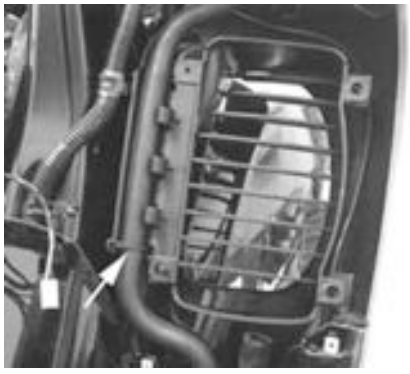
- Remove the counter-shield;
- Remove the right radiator inlet and outlet cooling fluid pipes;
- Release the 4 screws fixing the radiator to the body;
- Release the radiator



- Release the piping from the plastic conveyor by removing the plastic clip shown in the figure. Then, remove the conveyor.



- The same procedure applies to the left radiator, but the electric fan must be removed first, by releasing the 3 screws shown in the figure.



For re-assembly, perform the operations for removal in the reverse order, applying new clips for the fluid piping and filling the cooling fluid circuit.

Front central cover

- Remove the «PIAGGIO» logo
- Release the screw shown in the figure
- Remove the radiator grill

INDEX OF TOPICS

PRE-DELIVERY	PRE DE

Before handing over the scooter, carry out the listed checks.

Warning- be very careful when handling fuel.

Aesthetic inspection

Appearance checks:

- Paintwork
- Fitting of plastics
- Scratches
- Dirt

Tightening torques inspection

Lock check

- Safety locks
- clamping screws

Safety locks

Rear shock absorber upper fitting
Rear shock absorber lower fitting Lower front shock absorber fitting
Front wheel shaft nut Front wheel screws Rear wheel screws
Front and rear wheel hub nut Front and rear brake calliper clamping screws
Frame - swinging arm bolt *
Swinging arm bolt - Engine
Engine arm pin - Frame arm
Handlebar lock nut
Lower steering ring nut
Upper steering ring nut

Electrical system

• Main switch

• Lights: high beam, low beam, parking (front and back), and the relative telltales

- Regulating the headlights according to the regulations currently in force

• Front and rear stop light buttons and relative light •Turn indicators and relative telltales

• Instrument lighting

• instruments: fuel and temperature indicator

•Instrument panel lights

• Horn

• Electrical start up

• Engine stopping with emergency stop switch

• Electrical saddle opening button

CAUTION

TO ENSURE MAXIMUM PERFORMANCE, THE BATTERY MUST BE CHARGED BEFORE USE. INADEQUATE CHARGING OF THE BATTERY BEFORE IT IS FIRST USED WITH A LOW LEVEL OF THE ELECTROLYTE SHORTENS THE LIFE OF THE BATTERY.

CAUTION

WHEN INSTALLING THE BATTERY, FIRST CONNECT THE POSITIVE CABLE AND THEN THE NEGATIVE CABLE.

WARNING

THE BATTERY ELECTROLYTE IS POISONOUS AND CAUSES SEVERE BURNS. IT CONTAINS SULPHURIC ACID. AVOID CONTACT WITH THE EYES, THE SKIN AND CLOTHING.
IN CASE OF CONTACT WITH THE EYES OR THE SKIN, RINSE GENEROUSLY WITH WATER FOR ABOUT 15 MINUTES AND SEEK IMMEDIATE MEDICAL ATTENTION.
IN CASE OF INGESTION, IMMEDIATELY DRINK LARGE QUANTITIES OF WATER OR VEGETABLE OIL. SEEK IMMEDIATE MEDICAL ATTENTION.
THE BATTERIES PRODUCE EXPLOSIVE GAS; KEEP THEM AWAY FROM OPEN FLAMES, SPARKS AND CIGARETTES. IF THE BATTERY IS CHARGED IN A CLOSED PLACE, TAKE CARE TO ENSURE ADEQUATE VENTILATION. ALWAYS PROTECT THE EYES WHEN WORKING CLOSE TO BATTERIES.
KEEP OUT OF REACH OF CHILDREN

CAUTION

NEVER USE FUSES WITH A CAPACITY HIGHER THAN THE RECOMMENDED CAPACITY. USING A FUSE OF UNSUITABLE RATING MAY SERIOUSLY DAMAGE THE scooter OR EVEN CAUSE A FIRE.

Levels check

Level check:

- Hydraulic brake fluid level

- Rear hub oil level

- Engine coolant level

Engine oil level

Road test

Test ride

- Cold start
- Instrument operations
- Response to the gas command
- Stability in acceleration and braking
- Rear and front brake efficiency
- Rear and front suspension efficiency
- Abnormal noise

Static test

Static control after the test ride:

• Hot engine restart
• Minimum seal (turning the handlebar)
• Uniform steering rotation
• Possible losses
• Electrical radiator fan operation

CAUTION

CHECK AND ADJUST TYRE PRESSURE WITH TYRES AT AMBIENT TEMPERATURE.

CAUTION

NEVER EXCEED THE RECOMMENDED INFLATING PRESSURES AS THE TYRES MAY BURST.

Functional inspection

Functional check up:

• Hydraulic braking system: lever travel
• Clutch: proper functioning check
• Engine: proper general functioning and no abnormal noise check
• Other: papers check, frame and engine number check, tools and equipment, licence plate fitting, lock check, tyre pressure check, driving mirror and any accessory fitting

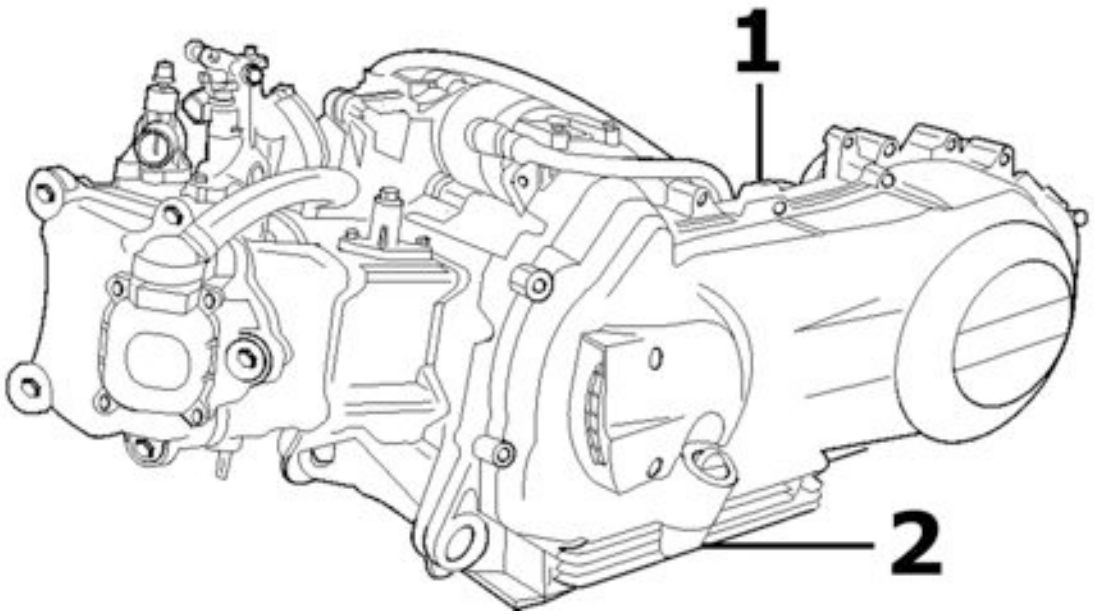
INDEX OF TOPICS

TIME	TIME

This section is devoted to the time necessary to carry out repairs.

For each operation, the description, code and time envisages are specified.

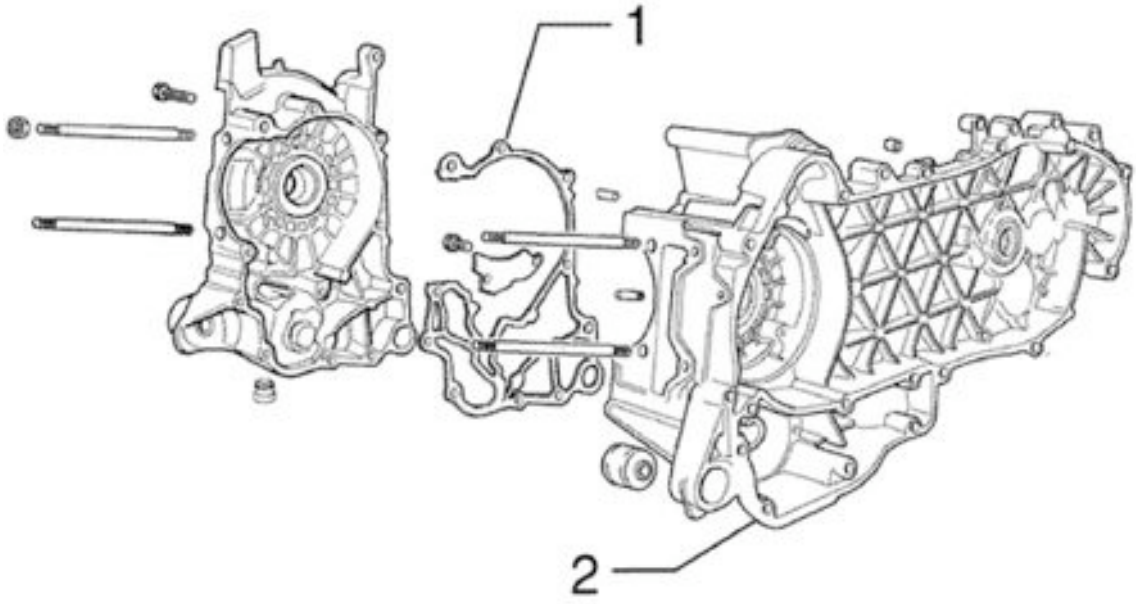
Engine



ENGINE

	Code	Action	Duration
1	001001	Engine from frame - remove and install	
2	003064	Engine oil - change	

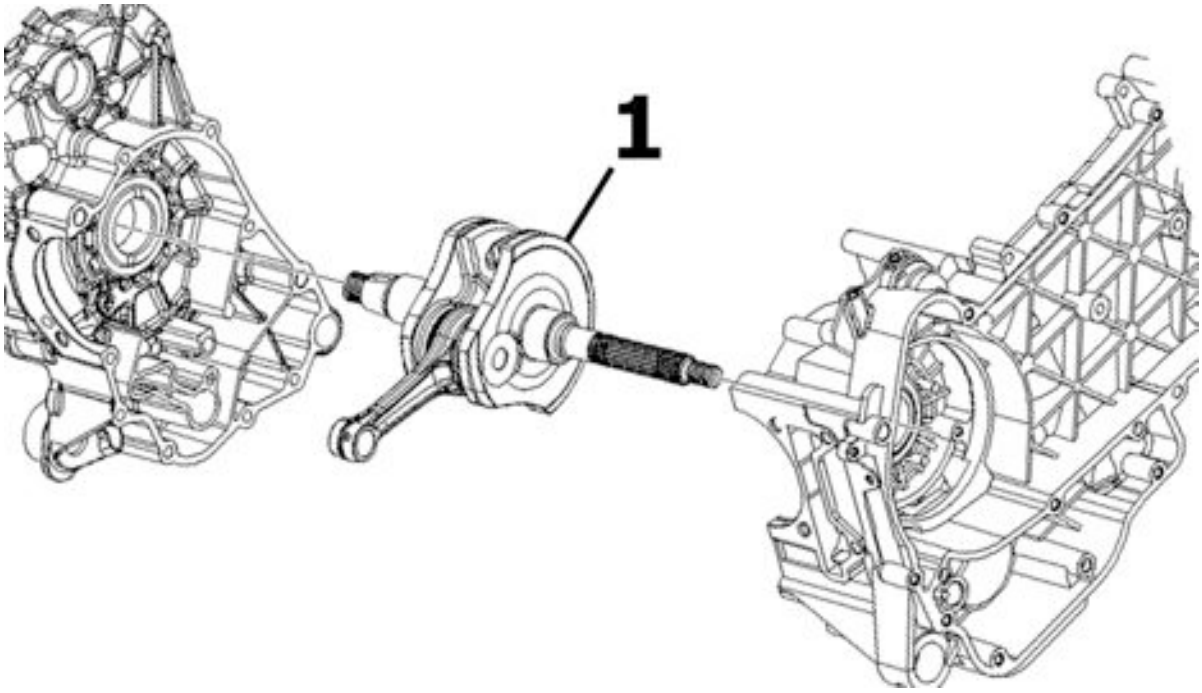
Crankcase



CRANKCASE

	Code	Action	Duration
1	001153	Half crankcase gasket - change	
2	001133	Engine crankcase - Replacement	

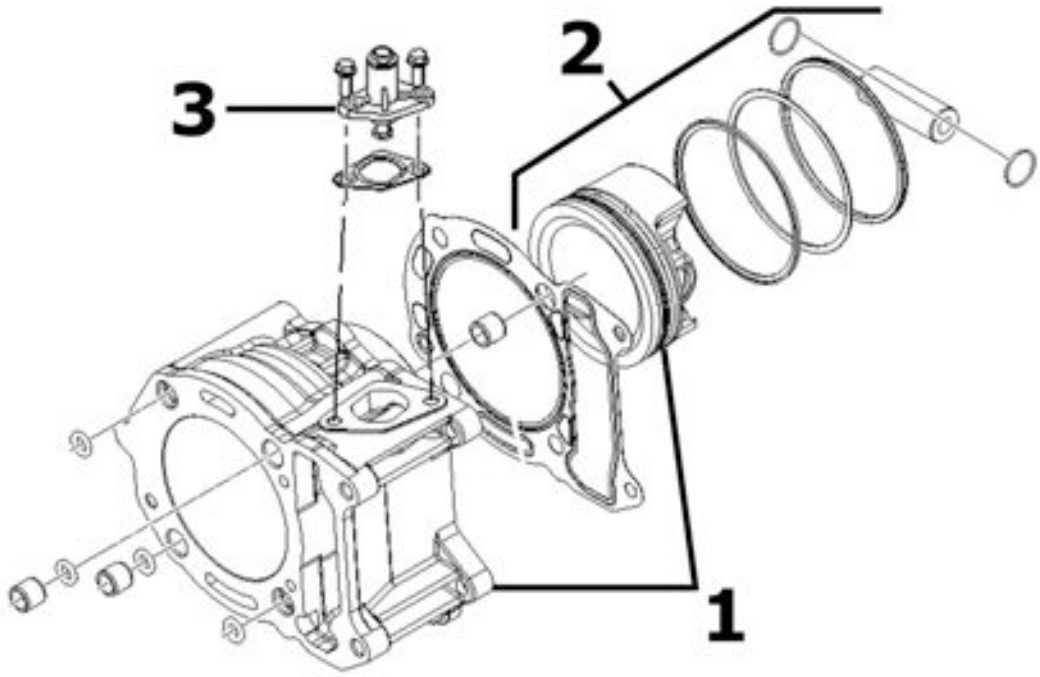
Crankshaft



CRANKSHAFT

	Code	Action	Duration
1	001117	Crankshaft - change	

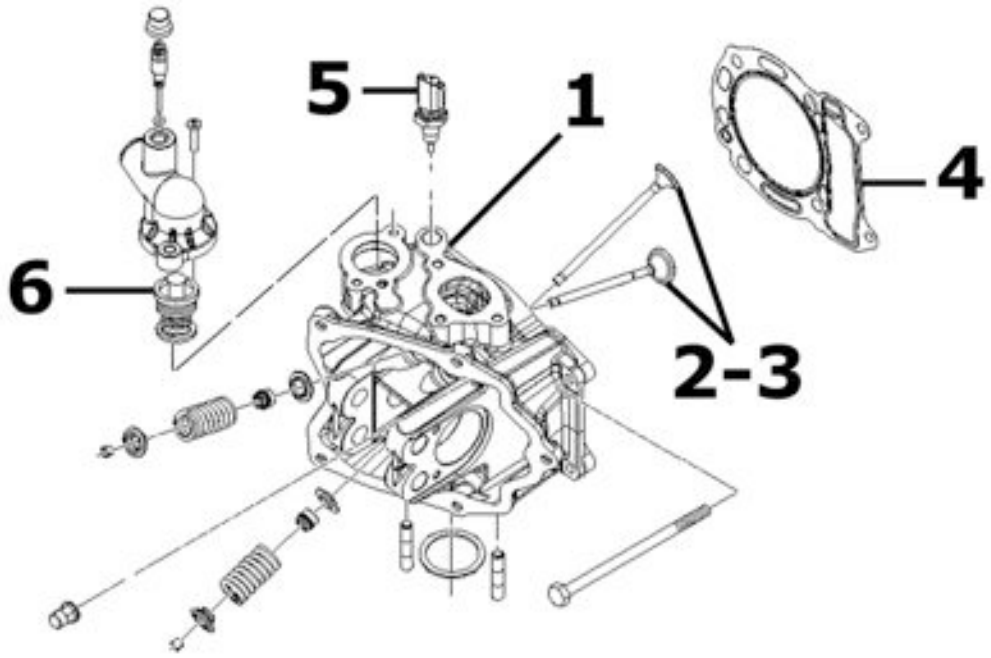
Cylinder assy.



CYLINDER- PISTON

	Code	Action	Duration
1	001002	Cylinder / piston - Replacement	
2	001154	Pin ring piston unit - overhaul	
3	001129	Chain tightener - overhaul and replace	

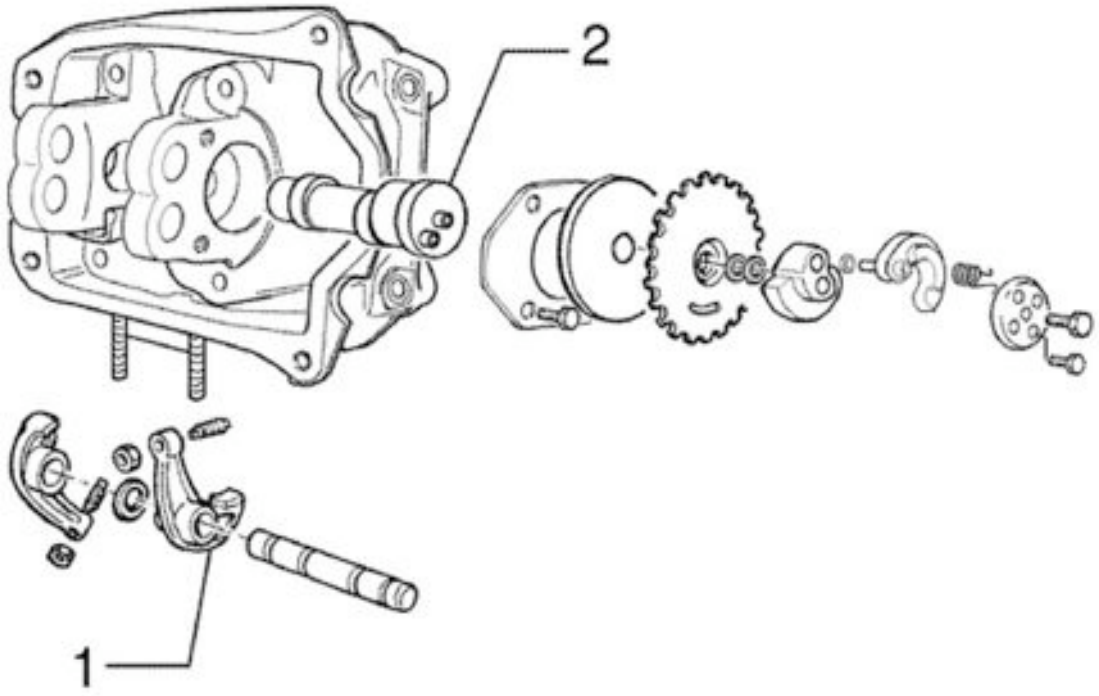
Cylinder head assy.



VALVE HEAD

	Code	Action	Duration
1	001126	Head - change	
2	001045	Valves - change	
3	001049	Valves - adjust	
4	001056	Head gasket - change	
5	001083	Thermistor - change	
6	001057	Thermostat - change	

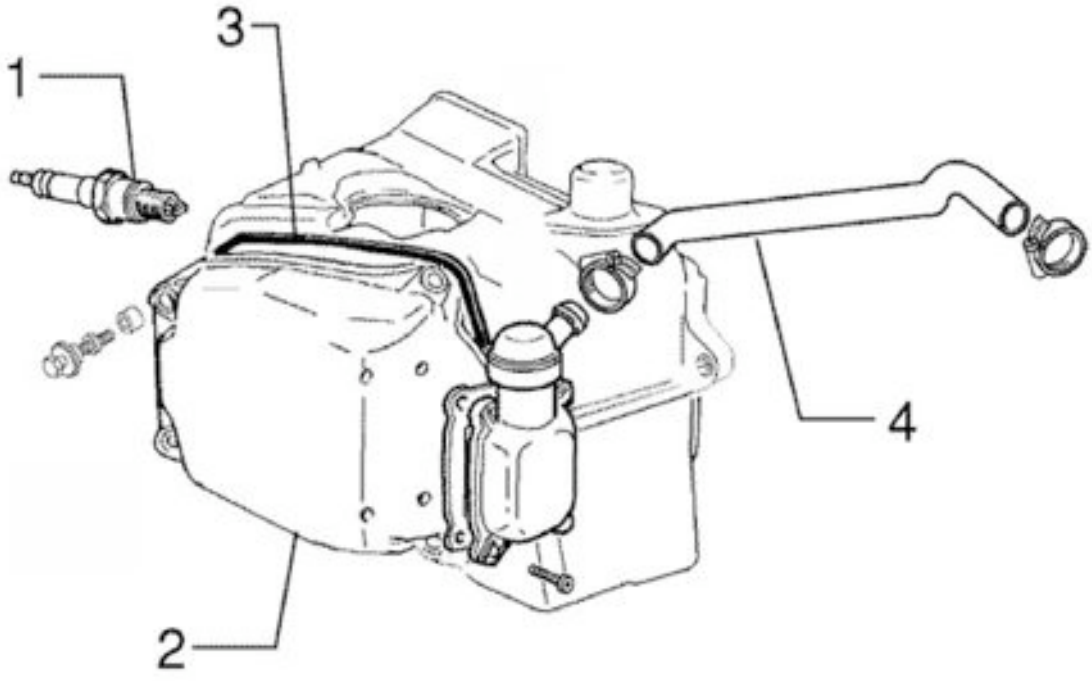
Rocker arms support assy.



CAM SHAFT

	Code	Action	Duration
1	001148	Valve rocker arms - change	
2	001044	Camshaft - change	

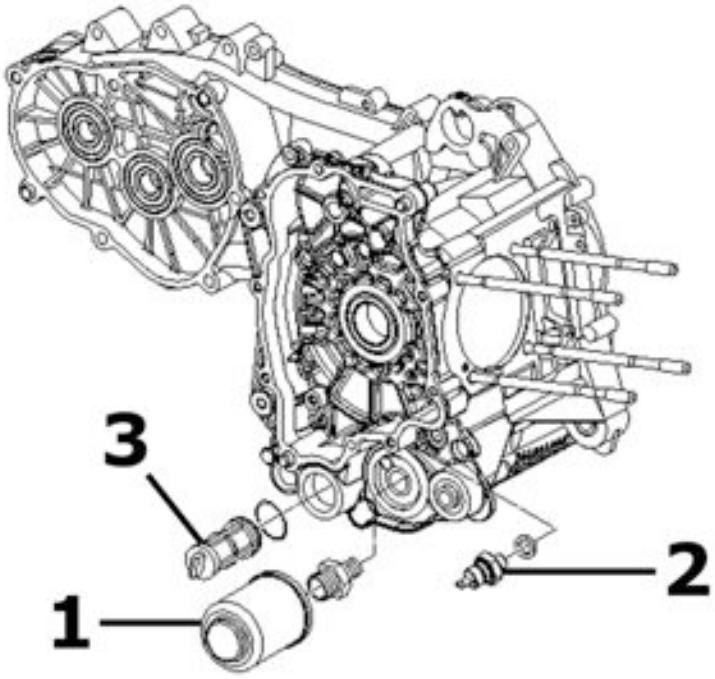
Cylinder head cover



HEAD COVER

	Code	Action	Duration
1	001093	Spark plug - Replacement	
2	001089	Head cover - change	
3	001088	Head cover gasket - change	
4	001074	Oil vapour recovery pipe - change	

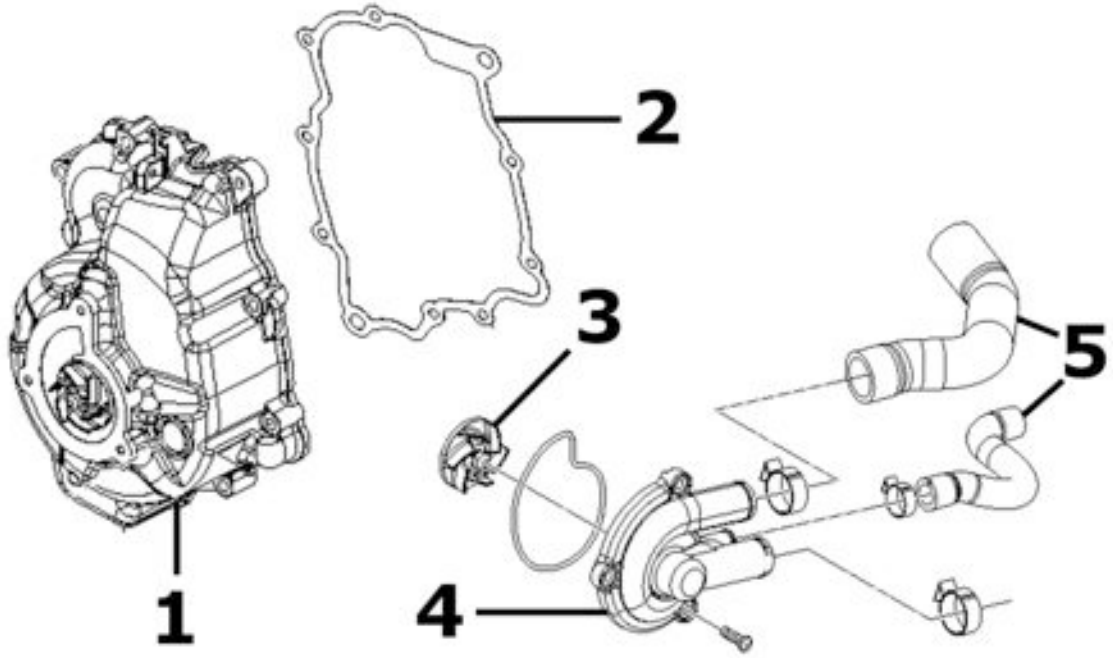
Oil filter



OIL FILTER

	Code	Action	Duration
1	001123	Oil filter - change	
2	001160	Oil pressure sensor - change	
3	001102	Net oil filter - change / Clean-ing	

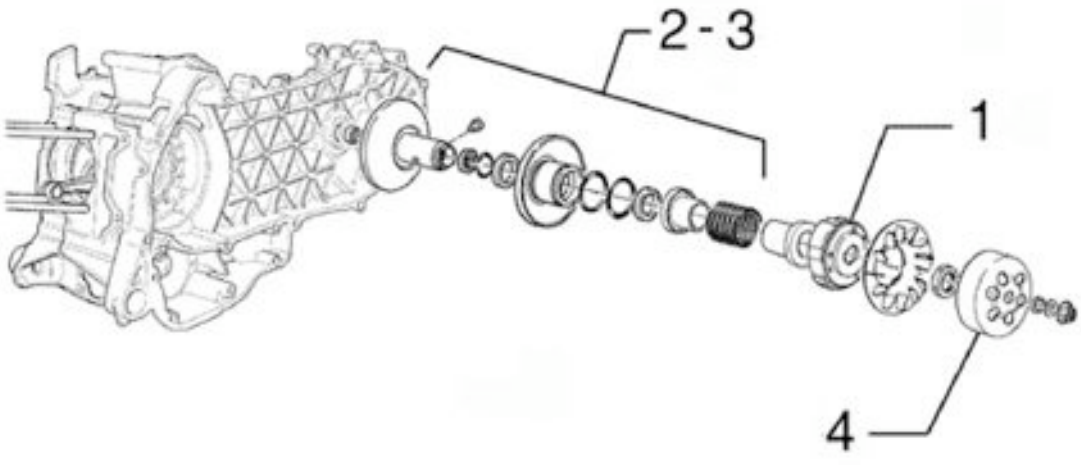
Flywheel cover



FLYWHEEL COVER

	Code	Action	Duration
1	001087	Flywheel cover - Replacement	
2	001150	Flywheel cover gasket - change	
3	007007	Water pump rotor cover	
4	007017	Water pump cover - change	
5	007003	Coolant delivery and return pipe - change	

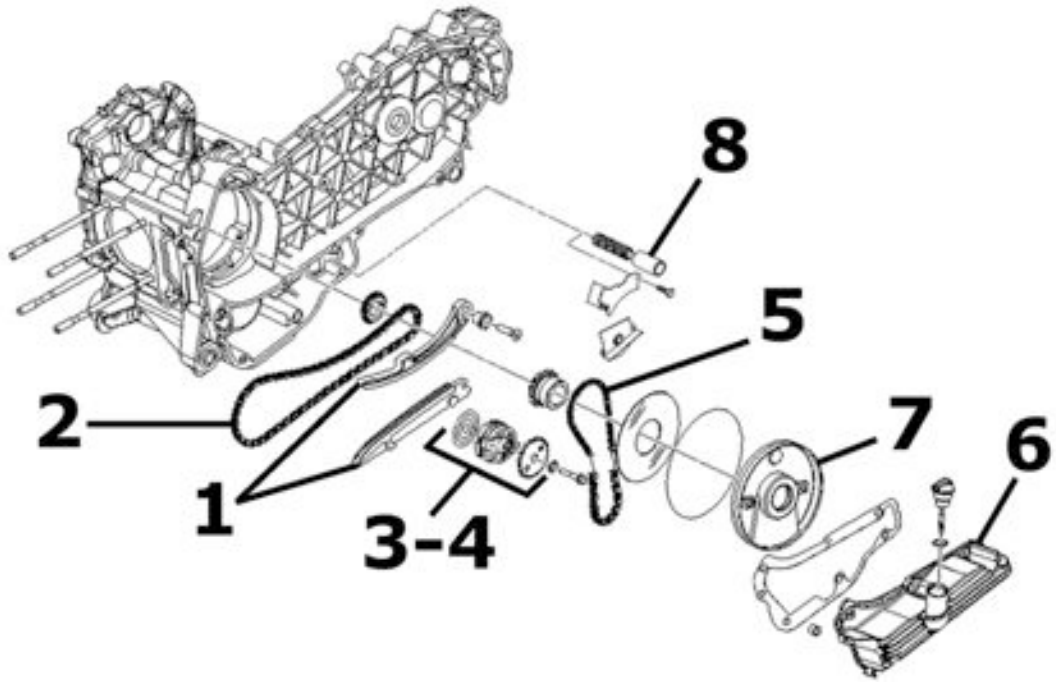
Driven pulley



DRIVEN PULLEY

	Code	Action	Duration
1	001022	Clutch - Replacement	
2	001012	Driven pulley - Service	
3	001110	Driven pulley- Replacement	
4	001155	Clutch bell - Replacement	

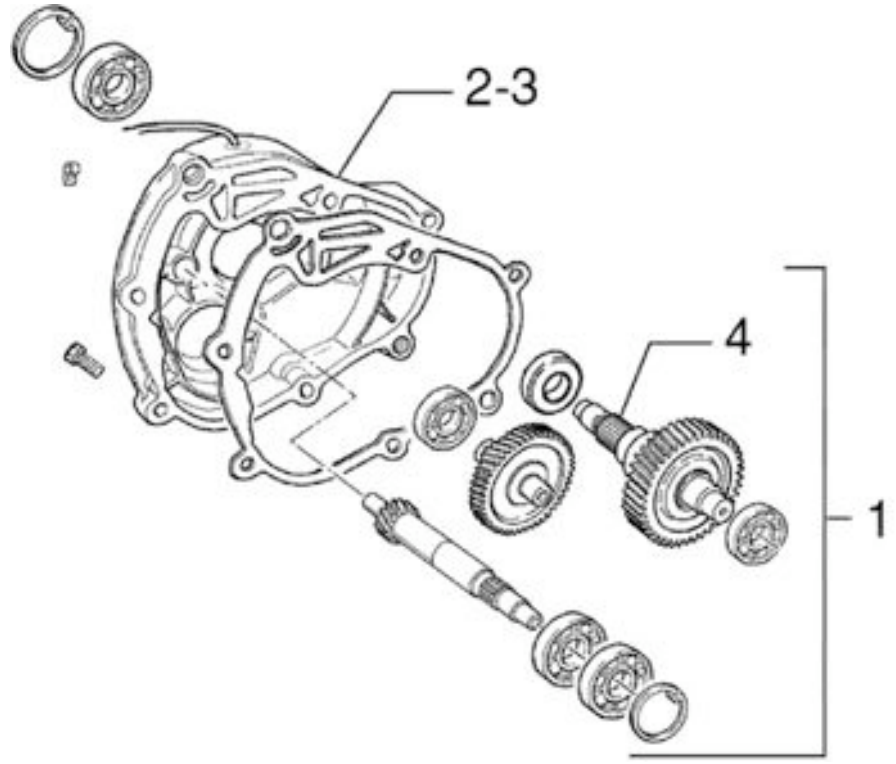
Oil pump



OIL PUMP

	Code	Action	Duration
1	001125	Chain guide pads - change	
2	001051	Belt/Timing chain - change	
3	001042	Oil pump - service	
4	001112	Oil pump - change	
5	001122	Oil pump chain - change	
6	001130	Oil sump - change	
7	001172	Chain cover flap - change	
8	001124	Lubrication by pass - change	

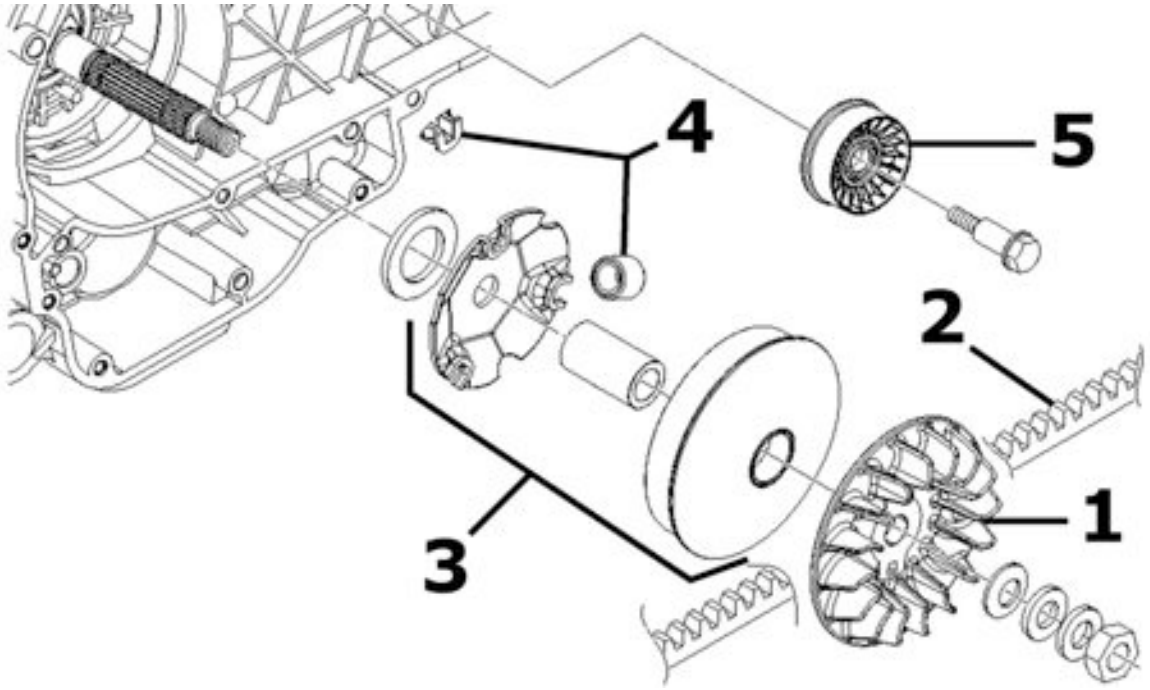
Final gear assy.



FINAL REDUCTION

	Code	Action	Duration
1	001010	Reduction gear-Replacement	
2	003065	Gearcase oil - Replacement	
3	001156	Geared reduction unit cover - change	
4	004125	Rear wheel axle - Replacement	

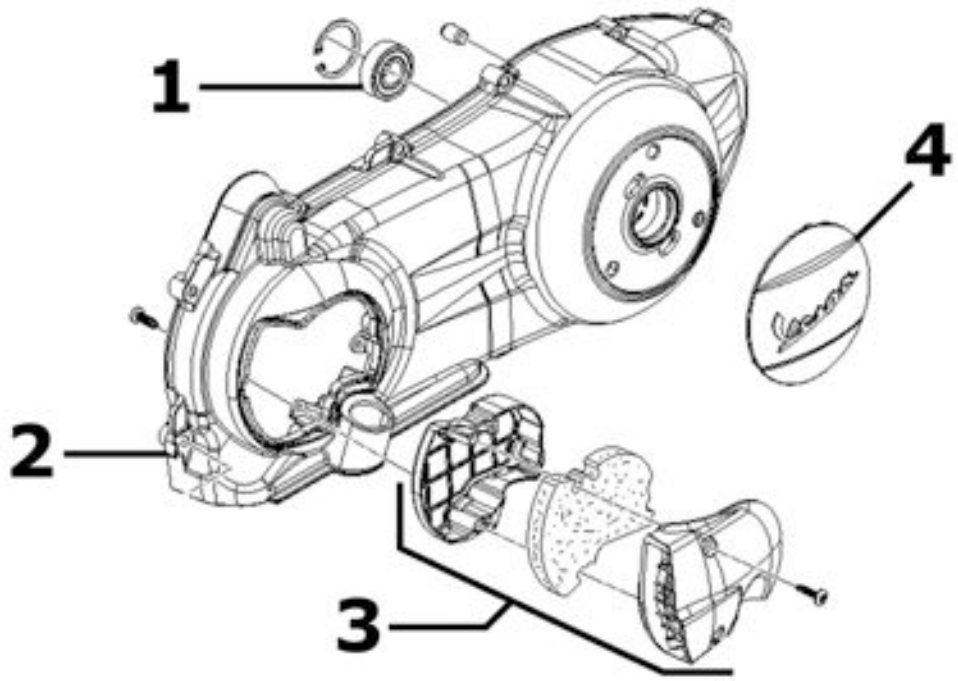
Driving pulley



DRIVE PULLEY

	Code	Action	Duration
1	001086	driving half-pulley - change	
2	001011	Driving belt - change	
3	001066	Drive pulley - Removal and refitting	
4	001177	Variator rollers / shoes - Replacement	
5	001141	Belt anti-vibration roller - change	

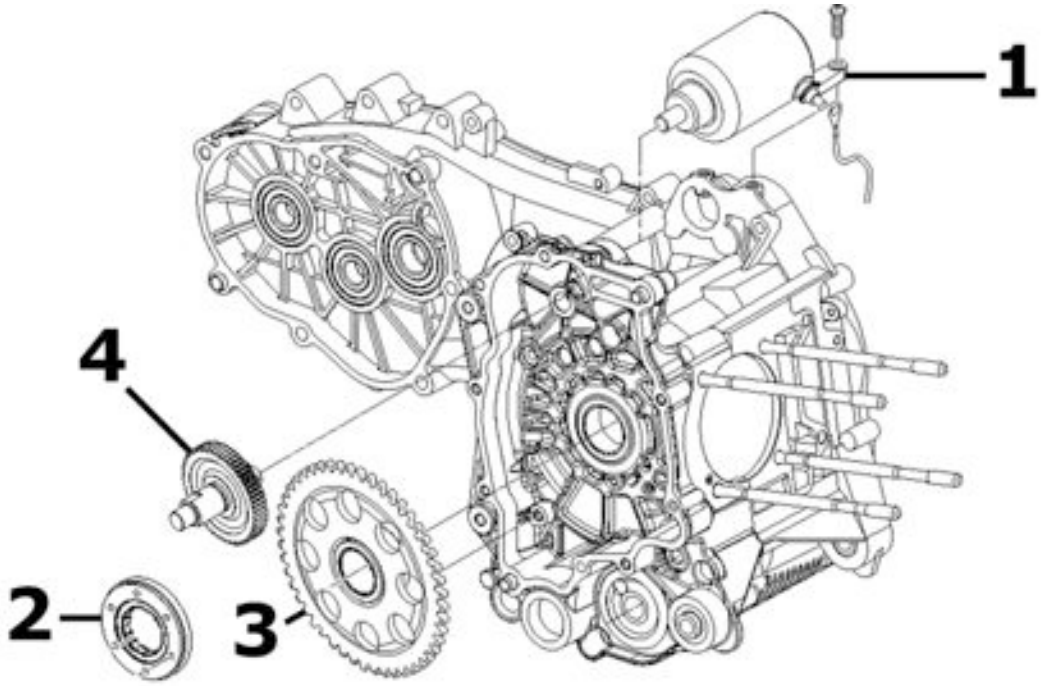
Transmission cover



TRANSMISSION COVER

	Code	Action	Duration
1	001135	Transmission cover bearing - change	
2	001096	Transmission crankcase cover - replace	
3	001131	Transmission air inlet - Replacement	
4	001065	Transmission cover - Replacement	

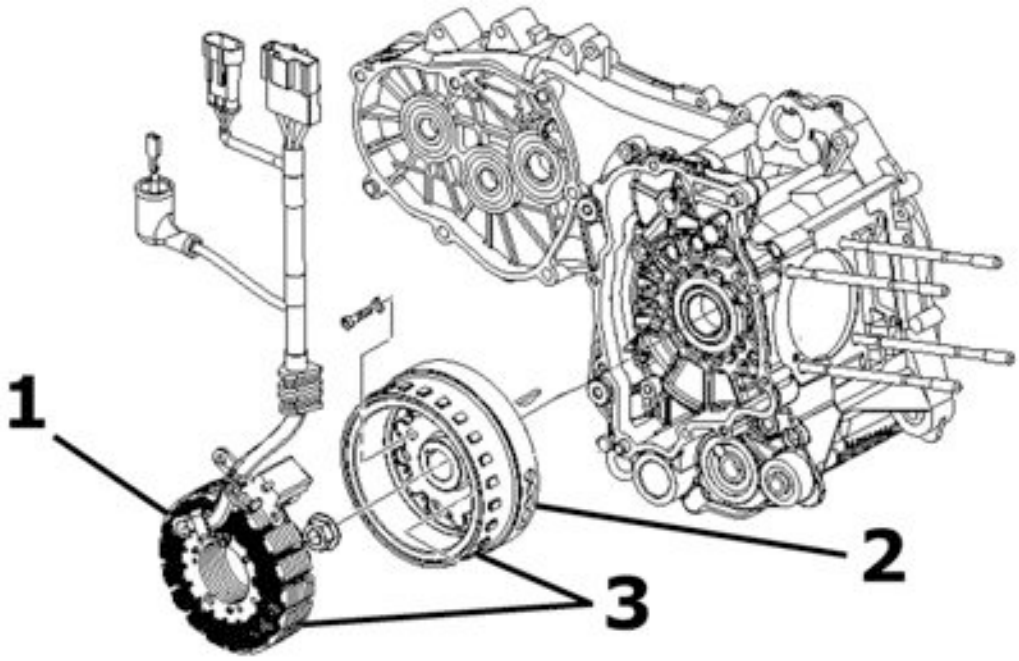
Starter motor



ELECTRICAL START UP

	Code	Action	Duration
1	001020	Starter motor - change	
2	001104	Start-up freewheel - change	
3	001151	Starter gearing - change	
4	001017	Starter pinion - change	

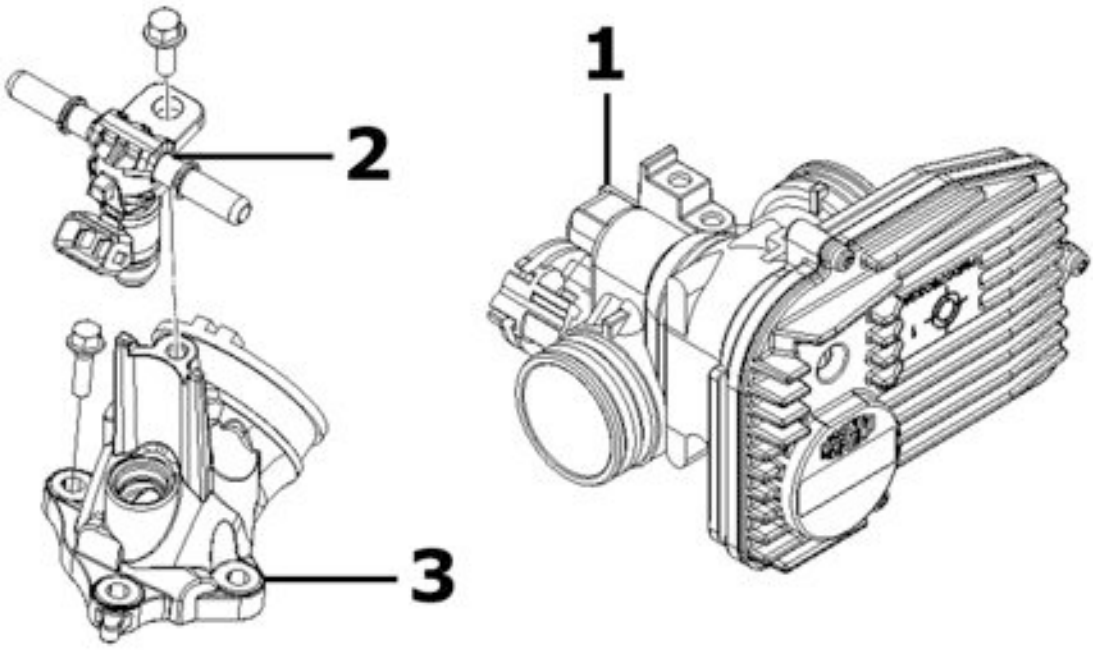
Flywheel magneto



MAGNETO FLYWHEEL

	Code	Action	Duration
1	001067	Stator - Removal and refitting	
2	001173	Rotor - Replacement	
3	001058	Complete flywheel - change	

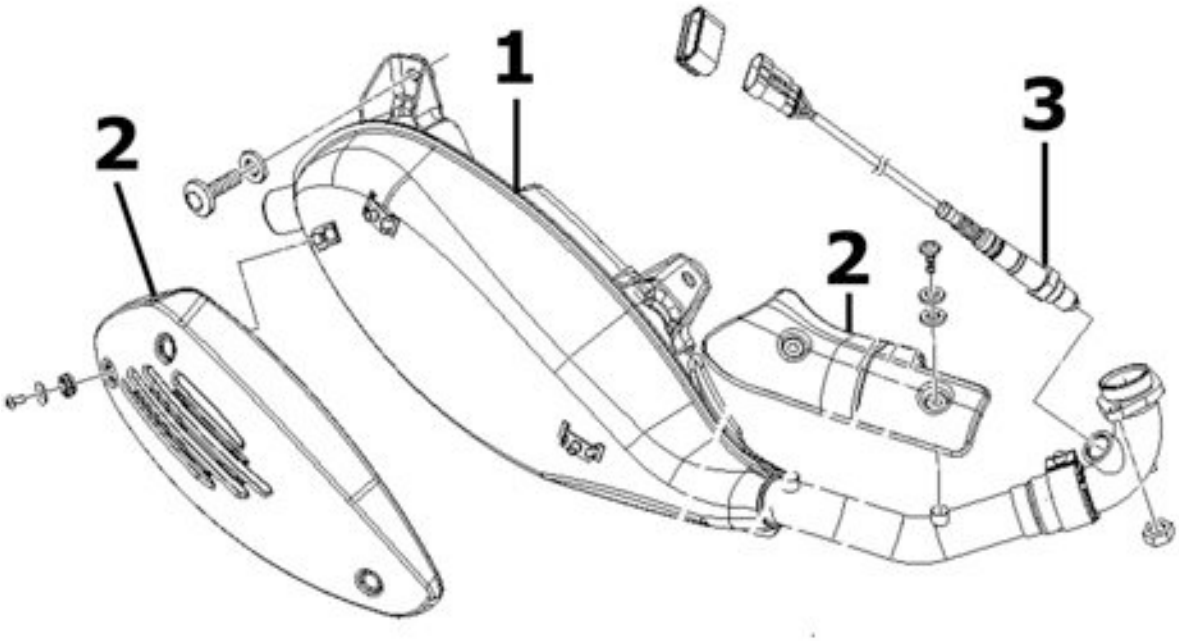
Butterfly valve



THROTTLE BODY

	Code	Action	Duration
1	001166	Throttle body - change	
2	001047	Injector - change	
3	001013	Intake manifold - change	

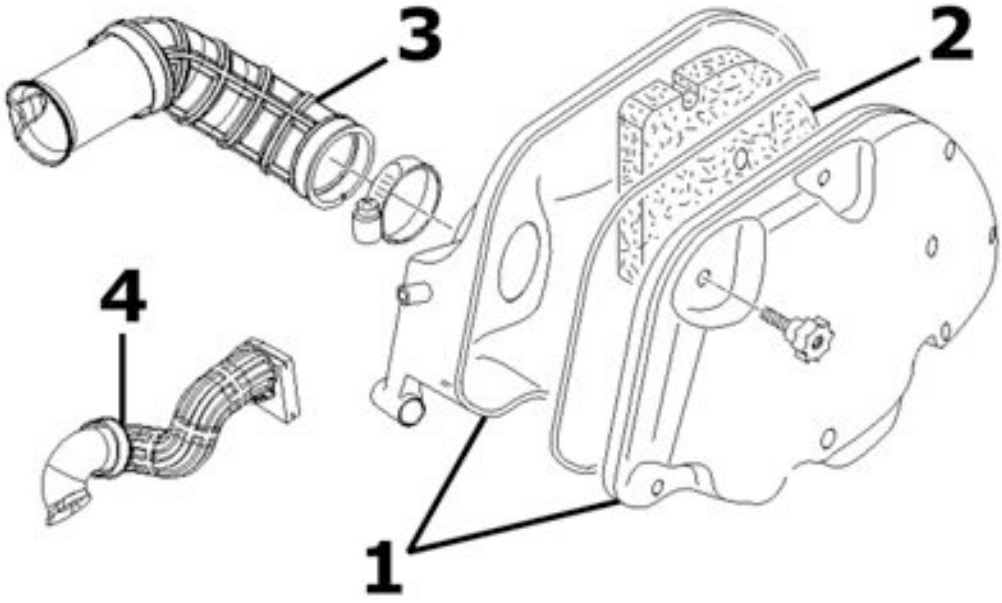
Exhaust pipe



MUFFLER

	Code	Action	Duration
1	001009	Muffler - change	
2	001095	Muffler guard - change	
3	005138	Lambda probe - change	

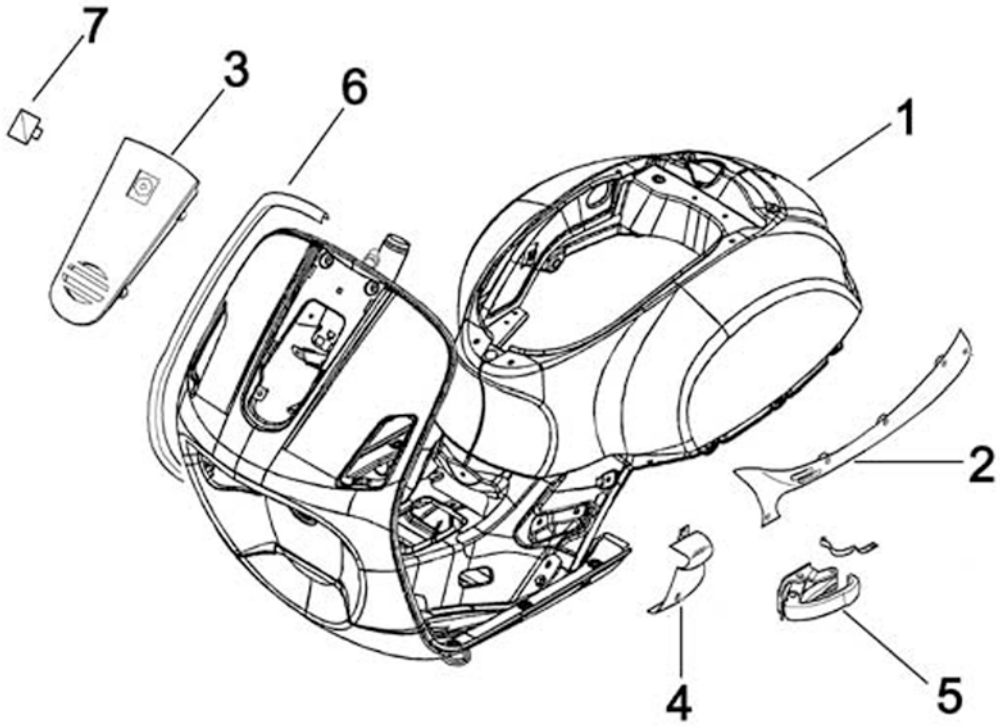
Air cleaner



AIR CLEANER

	Code	Action	Duration
1	001015	Air filter box - change	
2	001014	Air filter - change / cleaning	
3	004122	Air cleaner carburettor fitting - change	
4	001027	Body / air cleaner union - change	

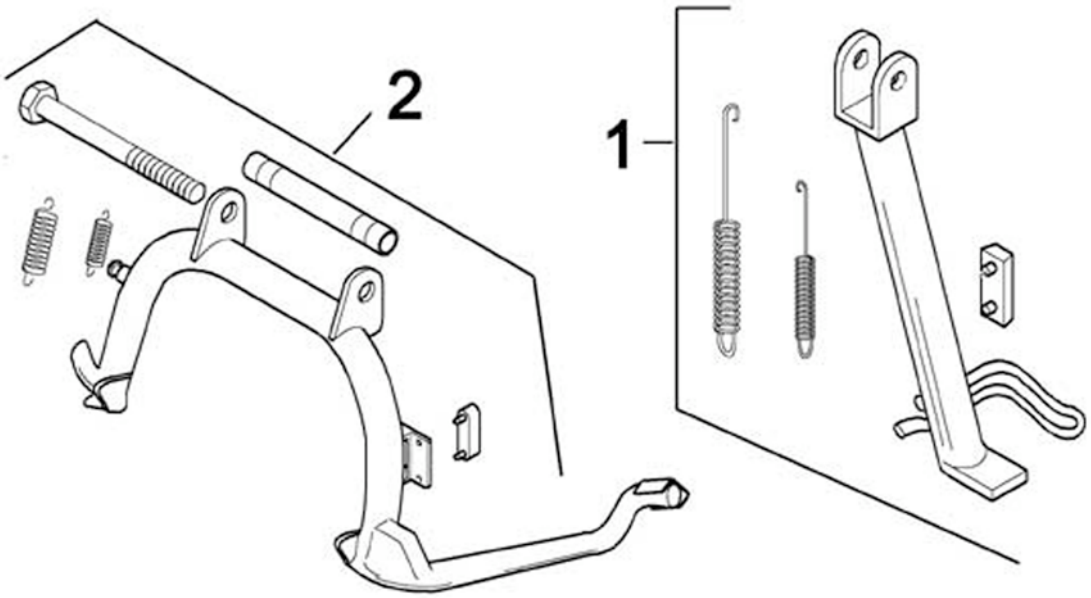
Frame



CHASSIS

	Code	Action	Duration
1	004001	Chassis - change	
2	004085	Side panel (1) - change	
3	004149	Front shield cover - change	
4	004053	Spoiler - change	
5	004015	Footrest - Disassembly and reassembly	
6	004023	Front shield beading - Re-placement	
7	004159	Plates / Stickers - change	

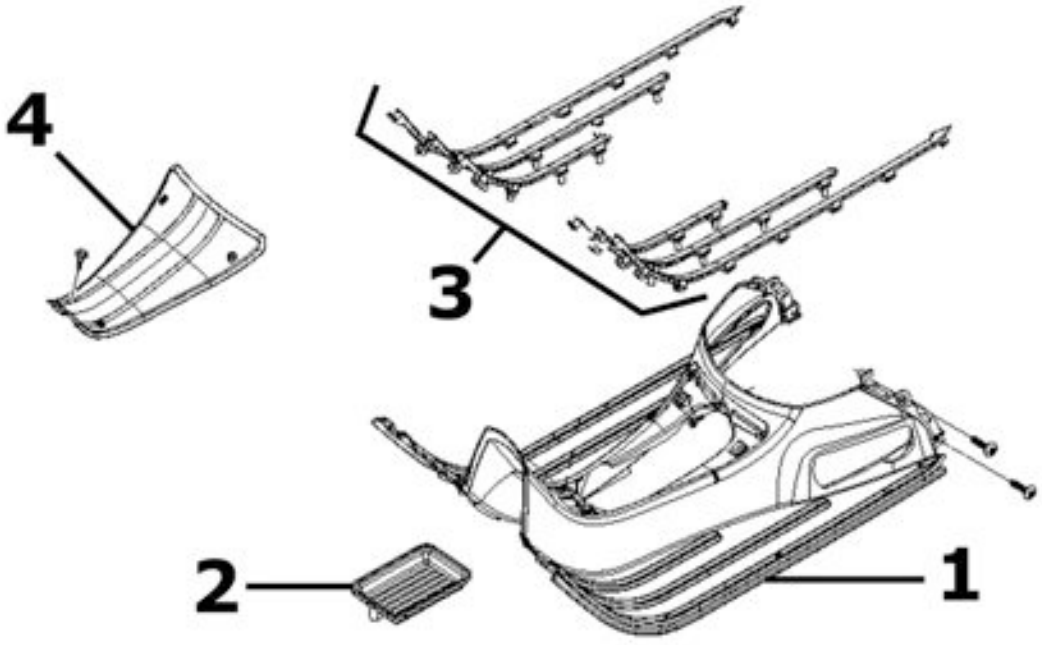
Centre-stand



STAND

	Code	Action	Duration
1	004102	Side stand - Replacement	
2	004004	Stand - Replacement	

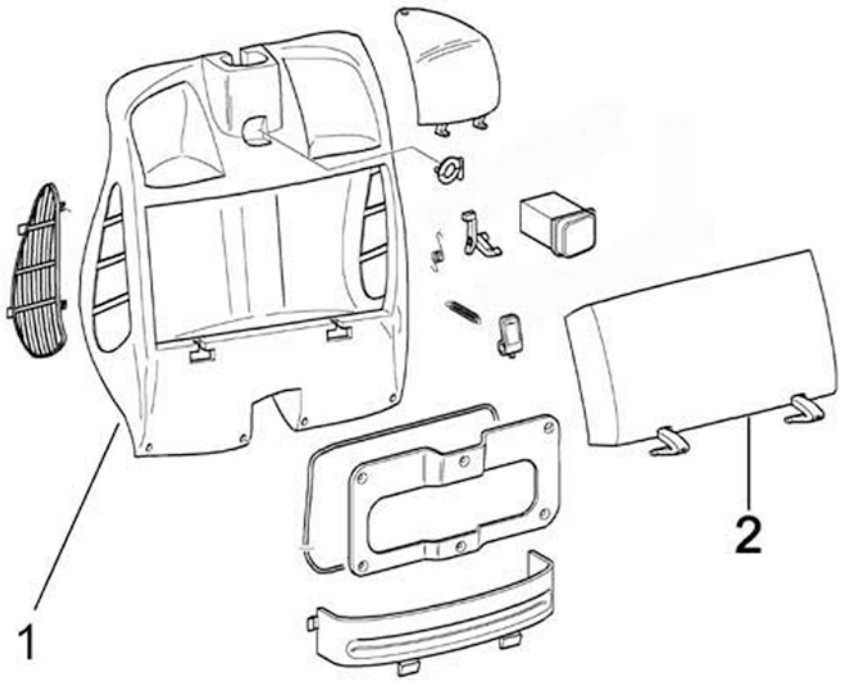
Footrests



FOOTRESTS

	Code	Action	Duration
1	004079	Footboard - Replacement	
2	004071	Battery compartment - Replacement	
3	004078	Front/rear footboard rubber. - Replacement	
4	005046	Battery cover - change	

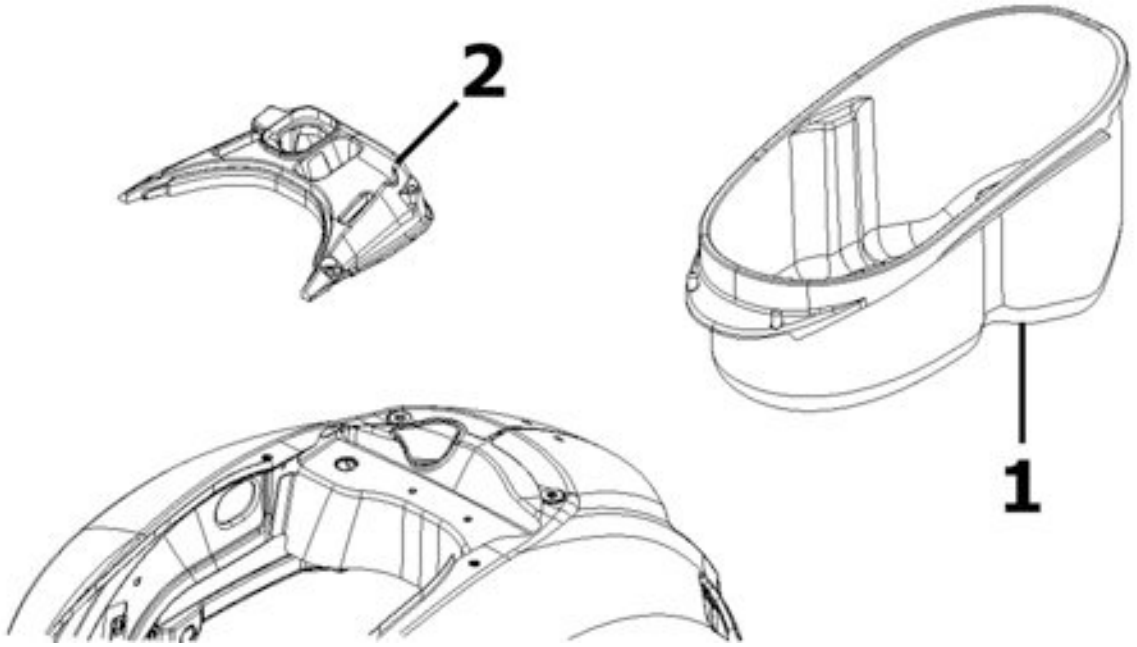
Rear cover



REAR COVER

	Code	Action	Duration
1	004083	Glove-box - Replacement	
2	004081	Glove compartment door - change	

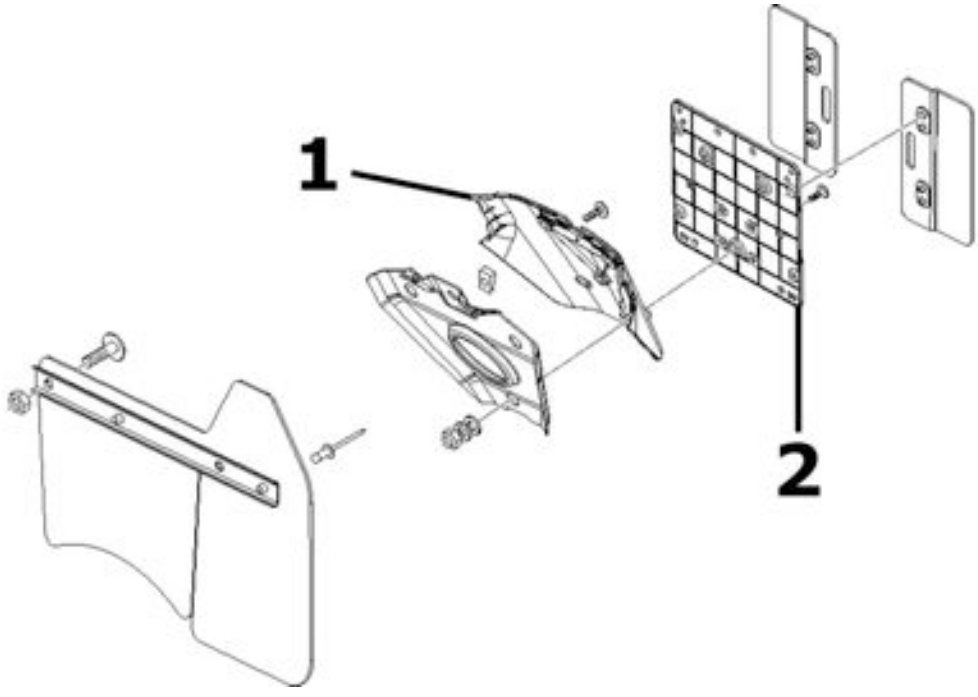
Underseat compartment



UNDERSEAT COMPARTMENT

	Code	Action	Duration
1	004016	Helmet compartment - Disassembly and reass	
2	004011	Chassis central cover - change	

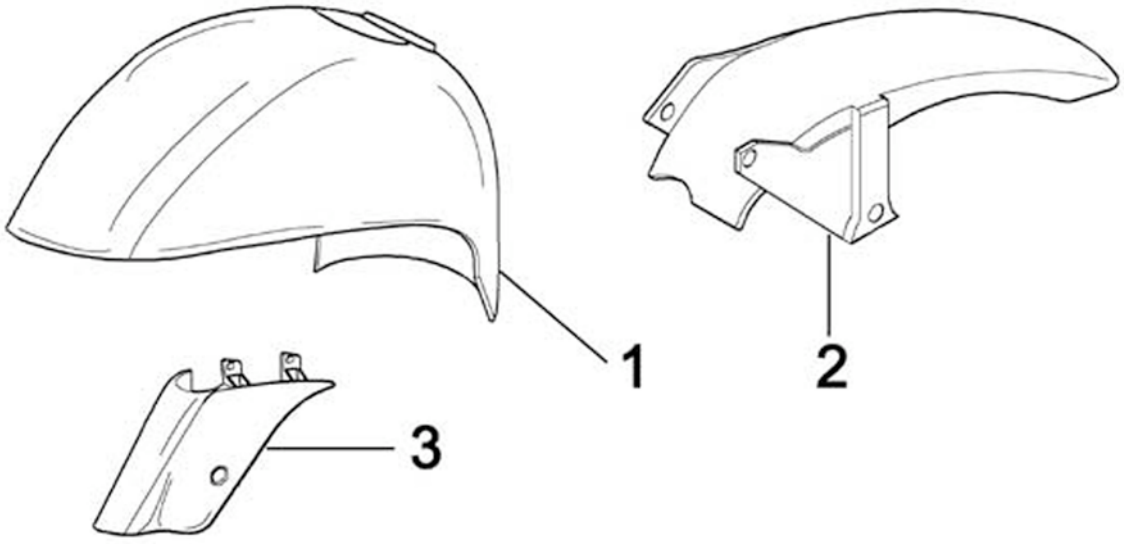
Plate holder



SUPPORT PLATE

	Code	Action	Duration
1	004136	License plate holder mounting bracket - Replacement	
2	005048	Plate holder - Replacement	

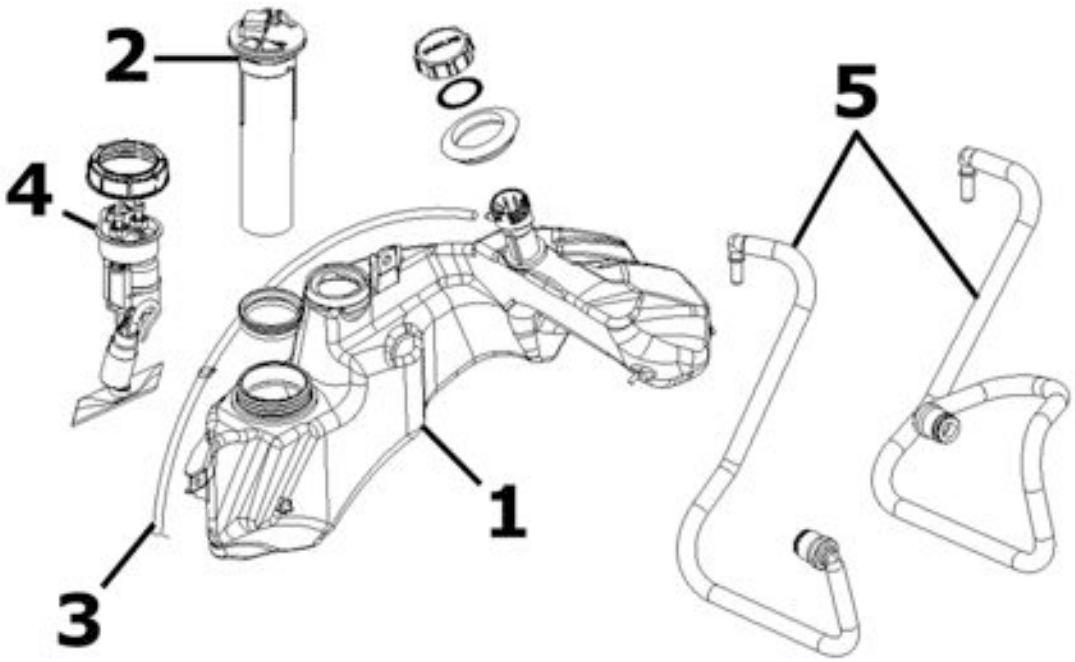
Mudguard



MUDGUARDS

	Code	Action	Duration
1	004002	Front mudguard - change	
2	004009	Rear mudguard - change	
3	003044	Shock absorber cover - Replacement	

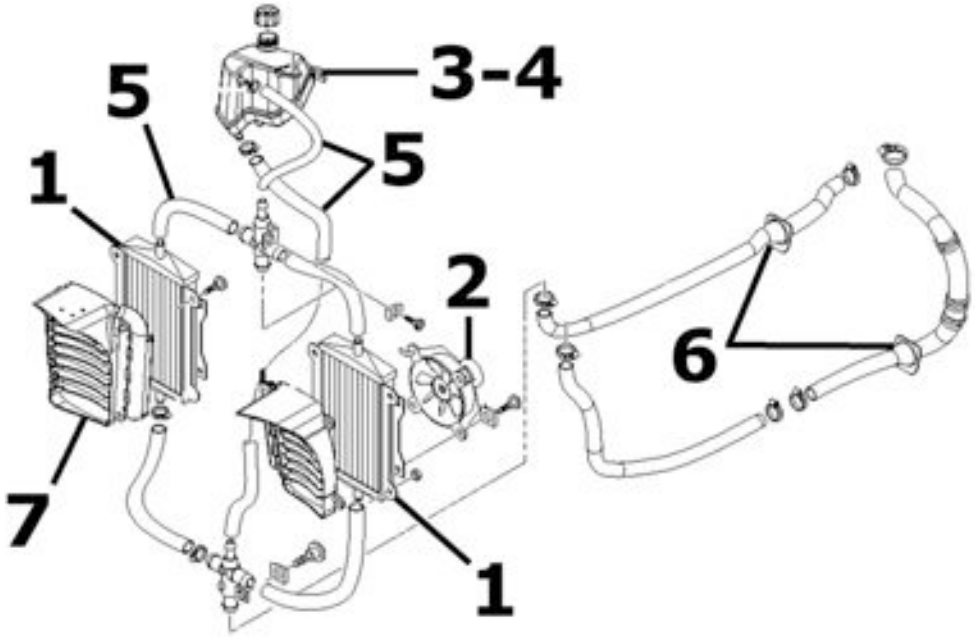
Fuel tank



FUEL TANK

	Code	Action	Duration
1	004005	Fuel tank - change	
2	005010	Tank float switch - Replacement	
3	004109	Fuel tank breather - change	
4	004073	Fuel pump - change	
5	004137	Pump injector hose - change	

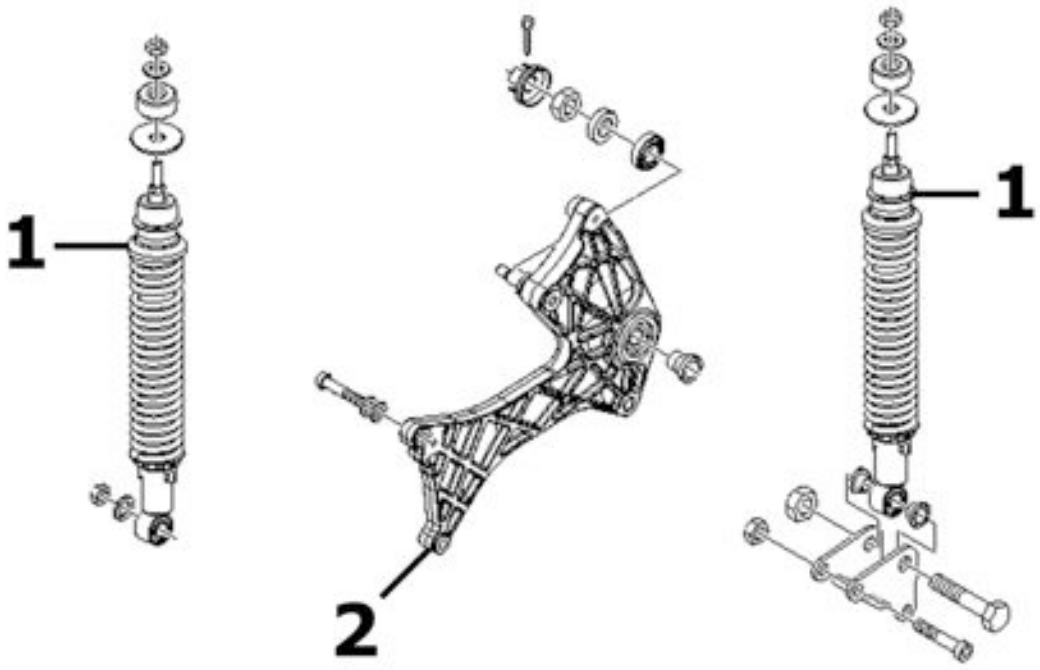
Radiator



RADIATOR

	Code	Action	Duration
1	007002	Water cooler - change	
2	007016	Fan complete with support - change	
3	007001	Expansion tank - change	
4	001052	Coolant and air release - change	
5	007013	Expansion tank / radiator connecting hose - change	
6	007003	Delivery line and coolant re-turn - change	
7	001170	Air duct - Replacement	

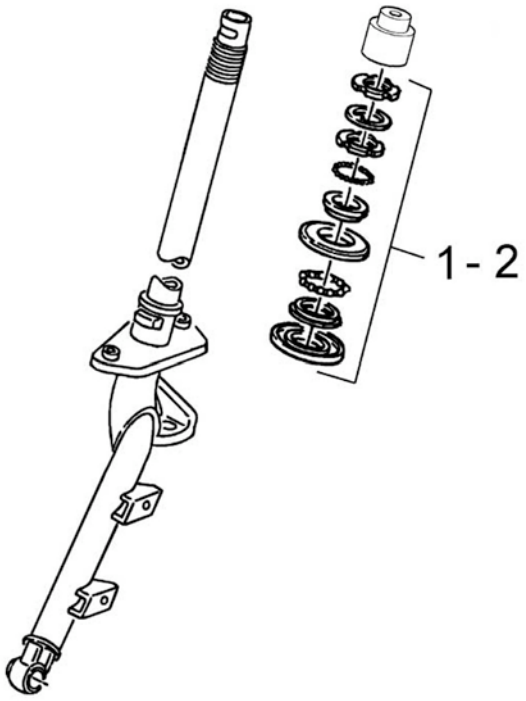
Rear shock-absorber



REAR SHOCK-ABSORBER

	Code	Action	Duration
1	003007	Rear shock absorber - Disassembly and reassembly	
2	003077	Rear shock absorber / silencer support arm - Overhaul	

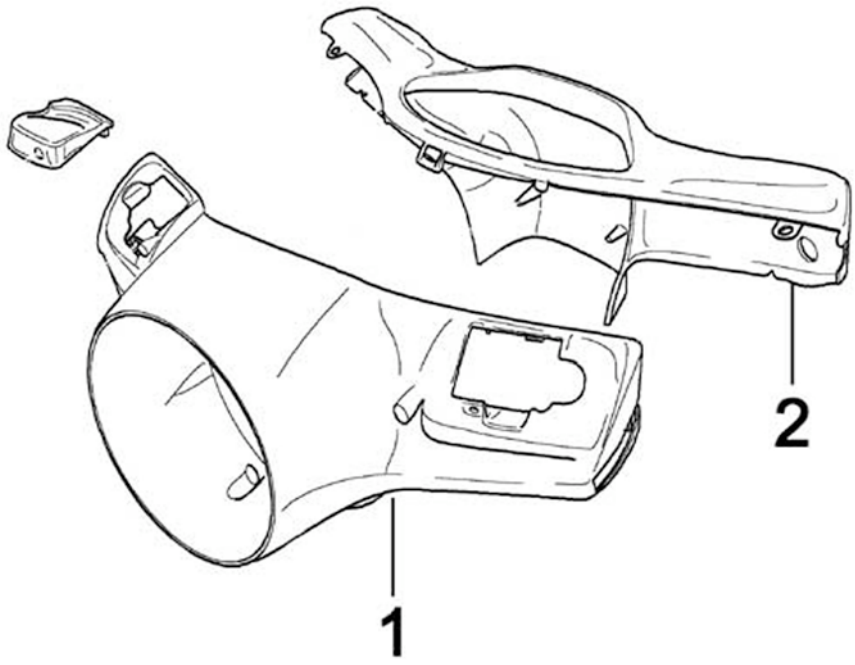
Steering column bearings



STEERING COLUMN BEARINGS

	Code	Action	Duration
1	003002	Steering thrust washer - replace	
2	003073	Steering backlash - adjust	

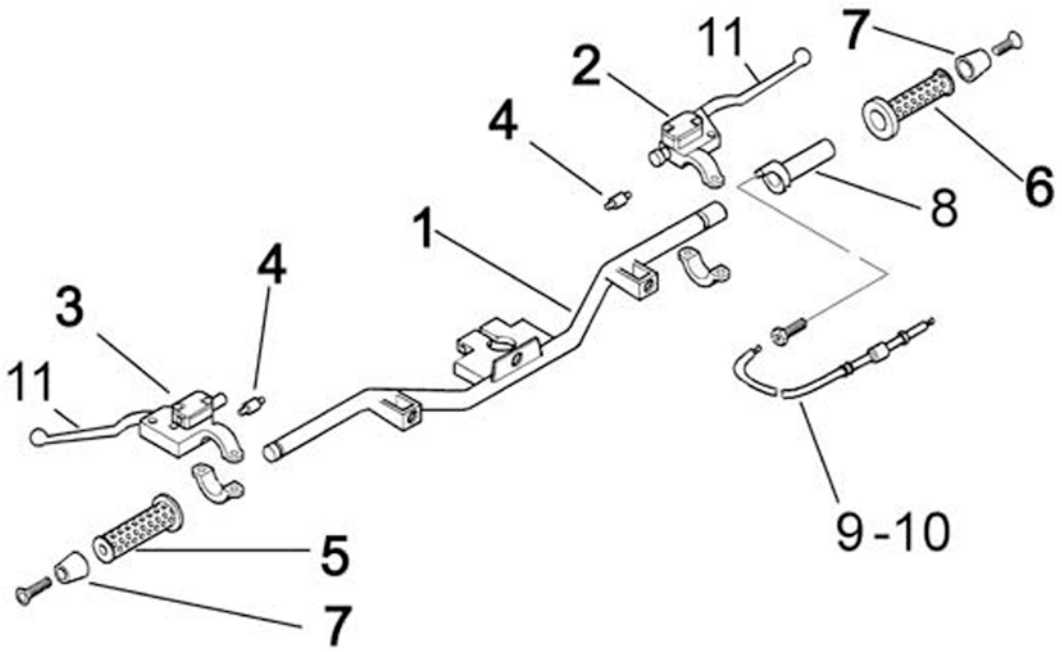
Handlebar covers



HANDLEBAR COVERS

	Code	Action	Duration
1	004018	Front handlebar covers - Replacement	
2	004019	Rear handlebar covers - Replacement	

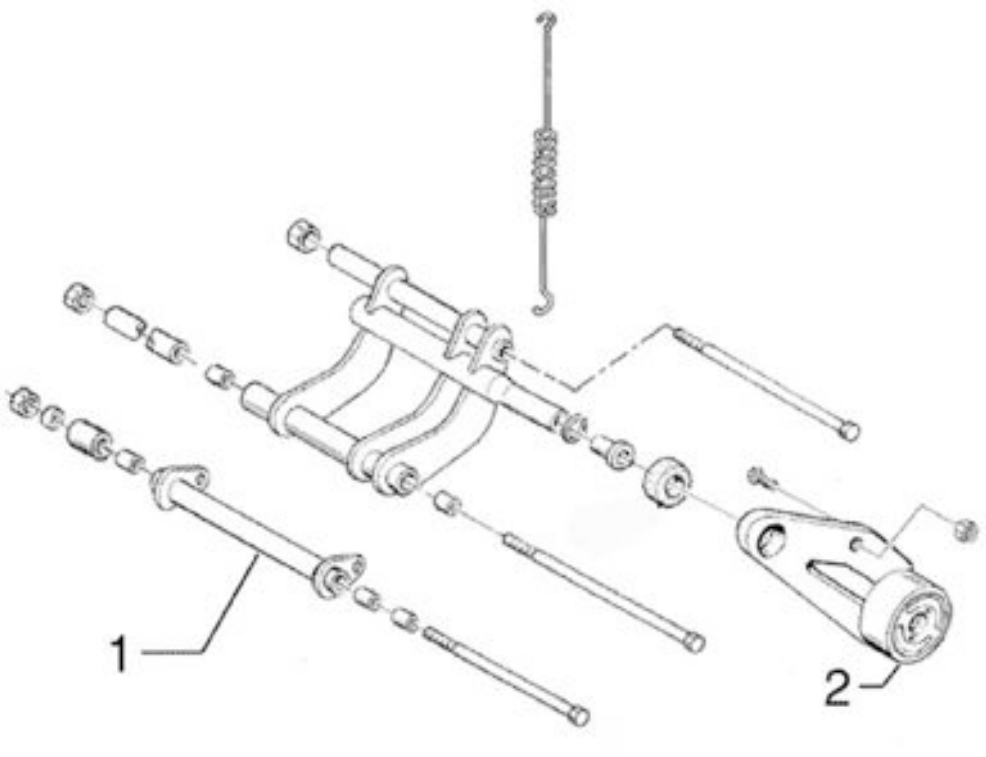
Handlebar components



HANDLEBAR COMPONENTS

	Code	Action	Duration
1	003001	Handlebar - Disassembly and reassembly	
2	002067	Rear brake pump - Replacement	
3	002024	Front brake pump - Removal and re-assembly	
4	005017	Stop switch - change	
5	002059	Right-hand knob - change	
6	002071	Left knob - change	
7	003059	Weight - Replacement	
8	002060	Throttle grip - change	
9	002063	Throttle control transmission - change	
10	003061	Accelerator transmission - adjust	
11	002037	Brake or clutch lever - change	

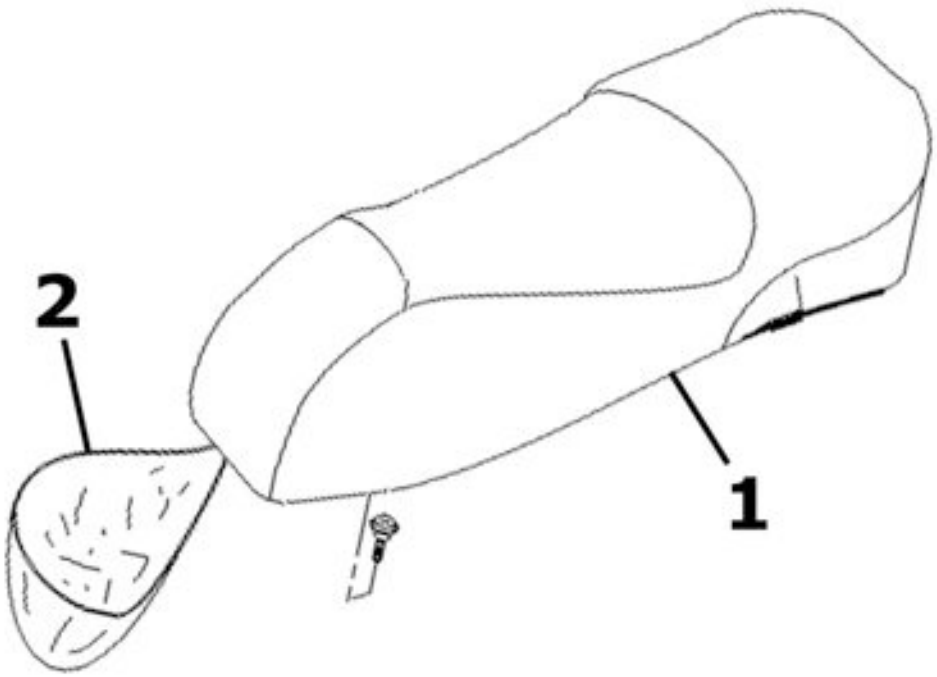
Swing-arm



SWINGING ARM

	Code	Action	Duration
1	001072	Engine-frame connection swinging arm - change	
2	004058	Silent bloc - change	

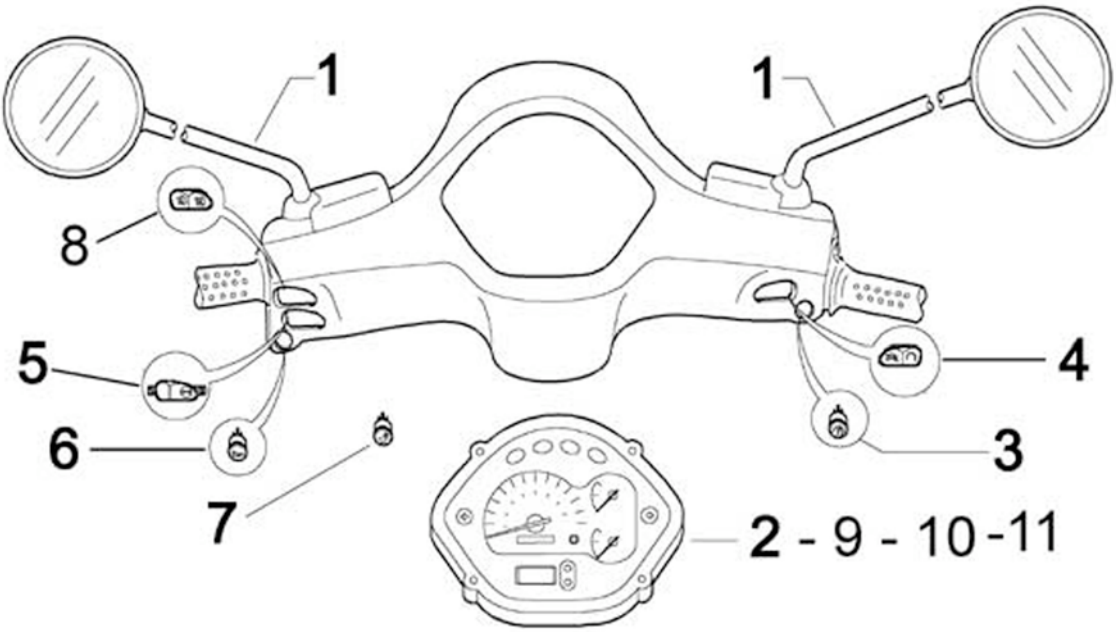
Seat



SADDLE

	Code	Action	Duration
1	004003	Saddle - change	
2	004144	Saddle cover - change	

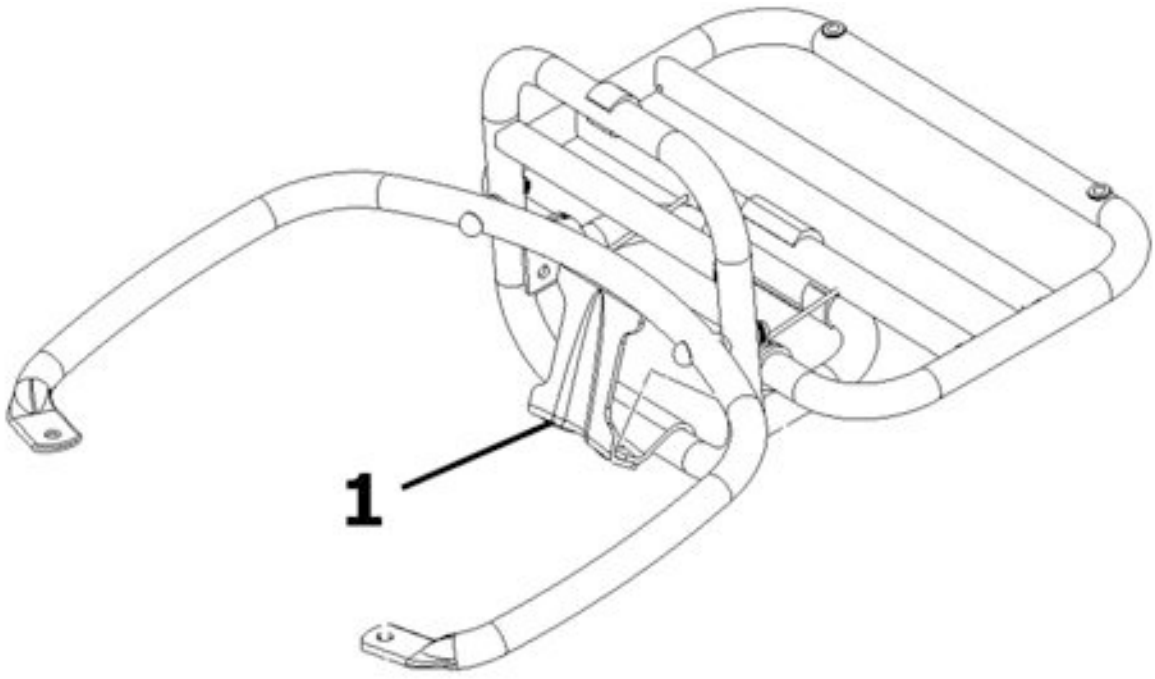
Instrument panel



LIGHT GROUP

	Code	Action	Duration
1	004066	Driving mirror - replace	
2	005014	Odometer - replace	
3	005041	Starter button - change	
4	005077	Emergency stop switch - Replacement	
5	005006	Light switch or flashers - change	
6	005040	Horn button - change	
7	005121	Seat opening button - change	
8	005039	Light switch - change	
9	005078	Odometer glass - change	
10	005038	Dashboard warning lights - change	
11	005076	Clock / battery - Replacement	

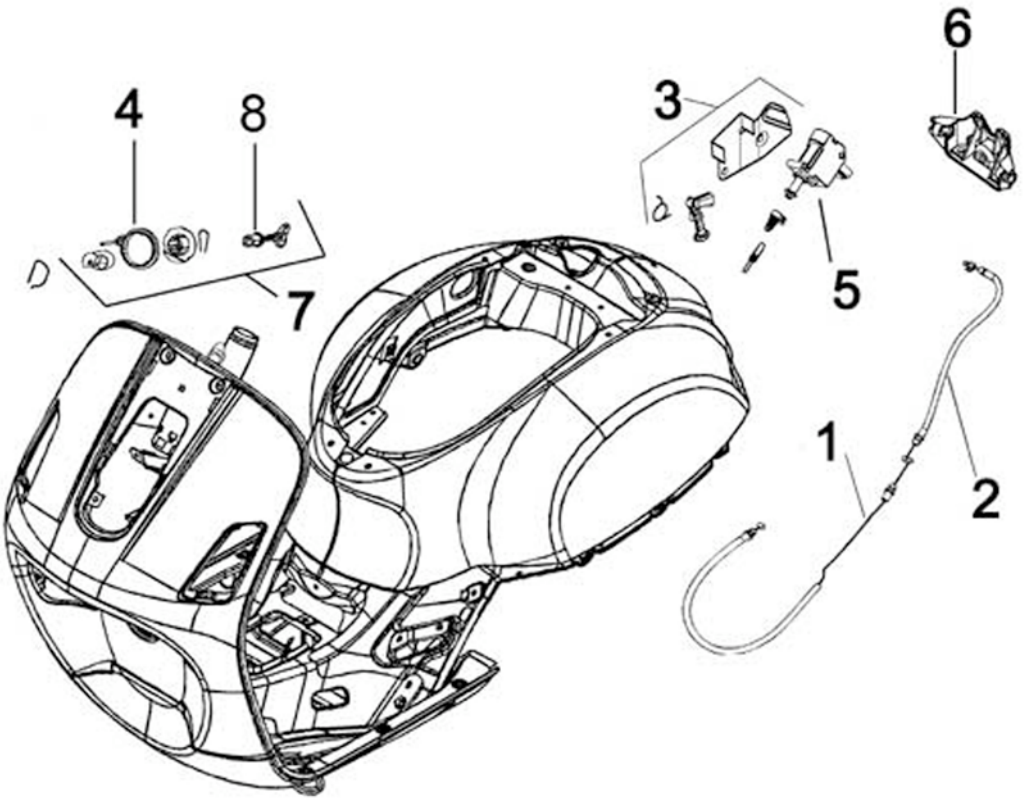
Rear rack



REAR RACK

	Code	Action	Duration
1	004008	Trunk rack - change	

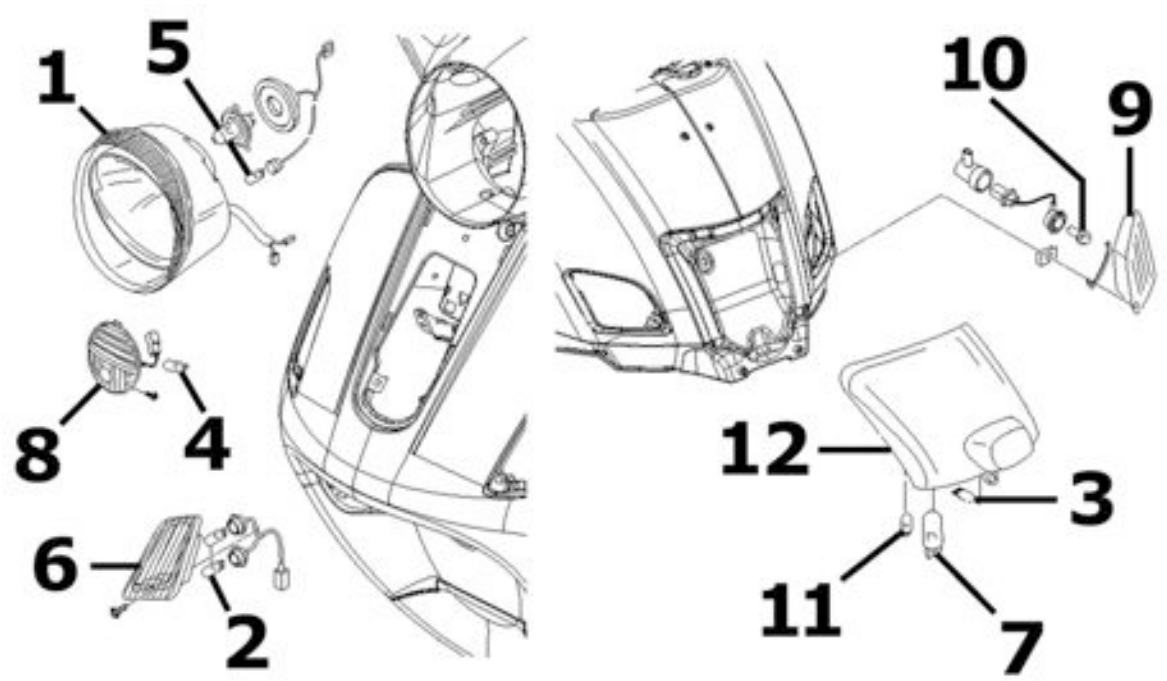
Locks



LOCKS

	Code	Action	Duration
1	002083	Transmission seat opening - change	
2	002092	Saddle coupling/splitter transmission - Repl.	
3	004158	Saddle opening splitter - change	
4	005072	Immobiliser antenna - Replacement	
5	005099	Saddle electric opening device - change	
6	004054	Saddle lock catch - change	
7	004010	Antitheft lock - Replacement	
8	005016	Ignition switch - change	

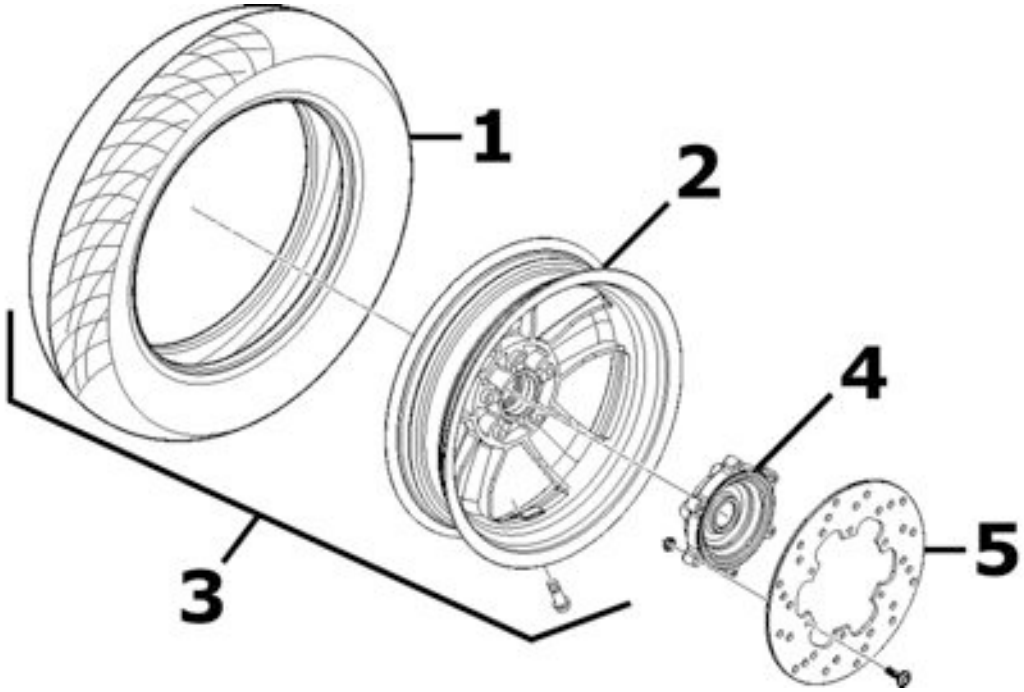
Turn signal lights



TURN SIGNAL LIGHTS

	Code	Action	Duration
1	005002	Front light - change	
2	005067	Front turn indicator bulb - change	
3	005031	Licence plate light bulb - change	
4	005139	Headlight bulb - Replacement	
5	005008	Front headlight bulbs - change	
6	005012	Front turn indicator - change	
7	005090	Brake light bulbs - Replacement	
8	005140	Rear tail lamp-front - Replacement	
9	005022	Rear turn indicators - replace	
10	005068	Rear turn indicator bulb - change	
11	005066	Rear light bulbs - change	
12	005028	Rear light assembly glass - Replacement	

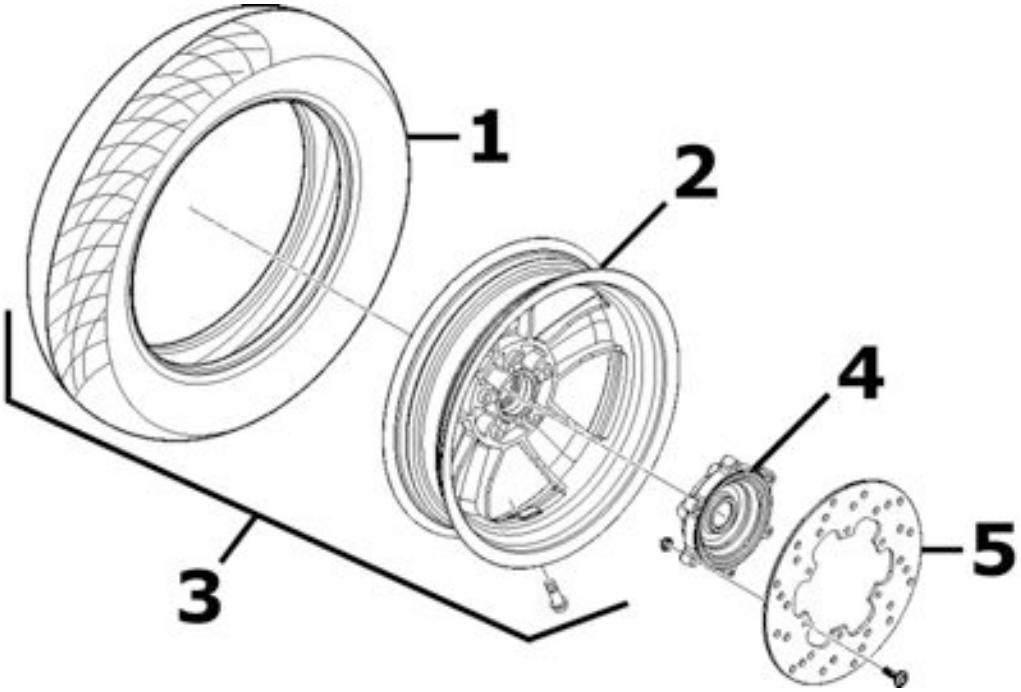
Front wheel



FRONT WHEEL

	Code	Action	Duration
1	003047	Front tyre - change	
2	003037	Front wheel rim- change	
3	004123	Front wheel - change	
4	003033	Front wheel hub - Replace-ment	
5	002041	Brake disc - change	

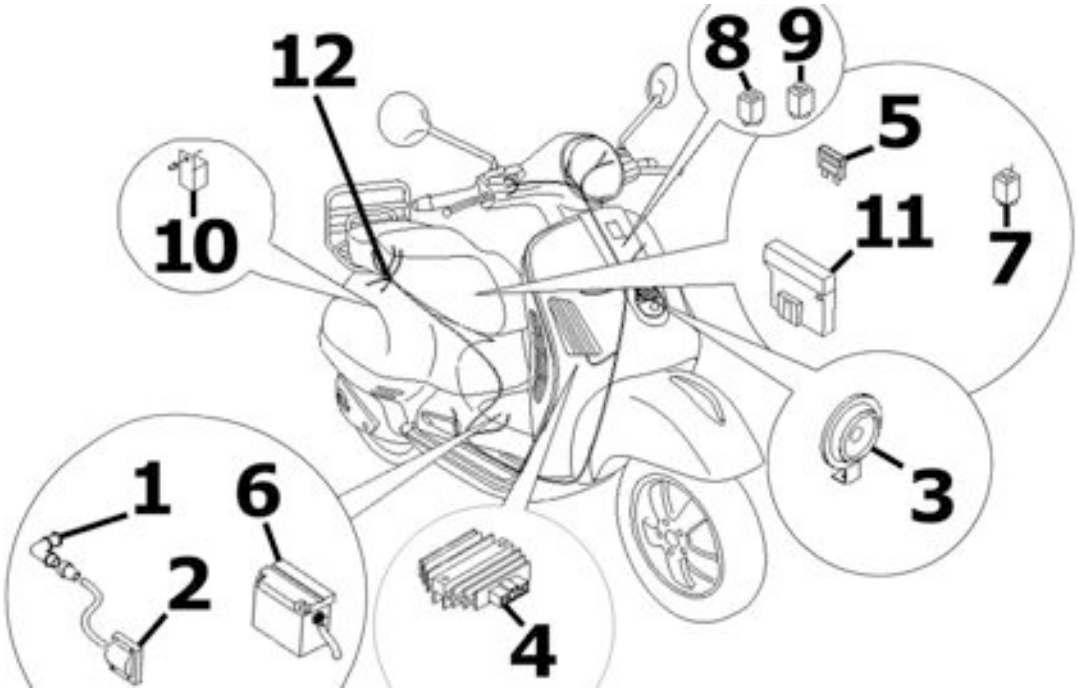
Rear wheel



REAR WHEEL

	Code	Action	Duration
1	004126	Rear wheel tyre - change	
2	001071	Rear wheel rim - Disassembly and reassembly	
3	001016	Rear wheel - replace	
4	002028	Rear wheel hub - change	
5	002070	Rear disc brake - Replacement	

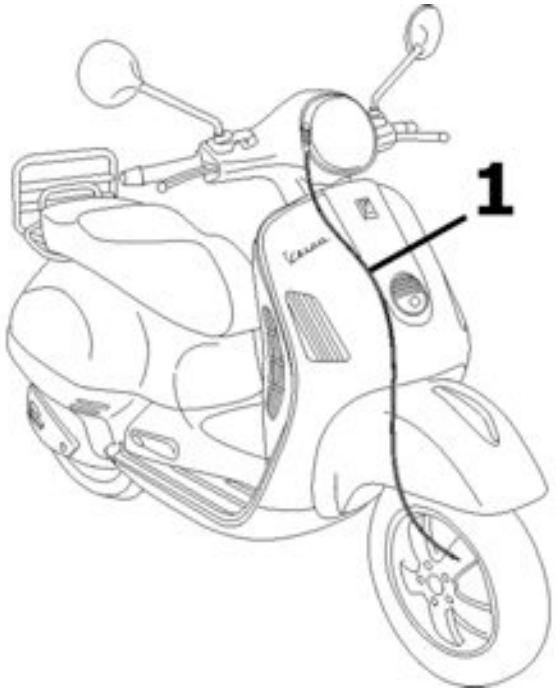
Electric devices



ELECTRICAL DEVICES

	Code	Action	Duration
1	001094	Spark plug cap - change	
2	001069	H.V. coil - change	
3	005003	Horn - change	
4	005009	Voltage regulator - change	
5	005052	Fuse (1) - change	
6	005007	Battery - change	
7	005120	Control unit supply remote control switch - change	
8	005035	Headlight remote control switch - change	
9	005117	Electric fan remote control switch - change	
10	005011	Start-up remote control switch - change	
11	005054	Fuse block (1) - change	
12	005001	Electrical system - Removal and refitting	

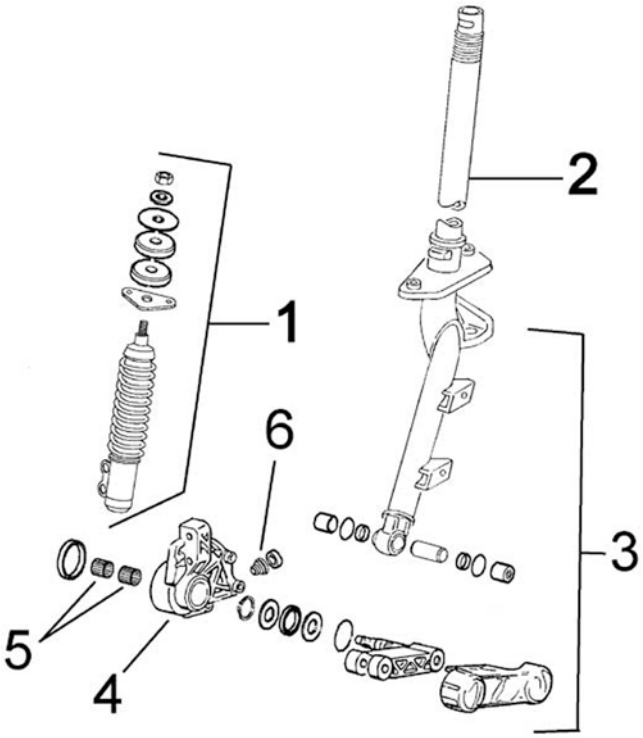
Transmissions



TRANSMISSIONS

	Code	Action	Duration
1	002051	Odometer transmissions assembly - change	

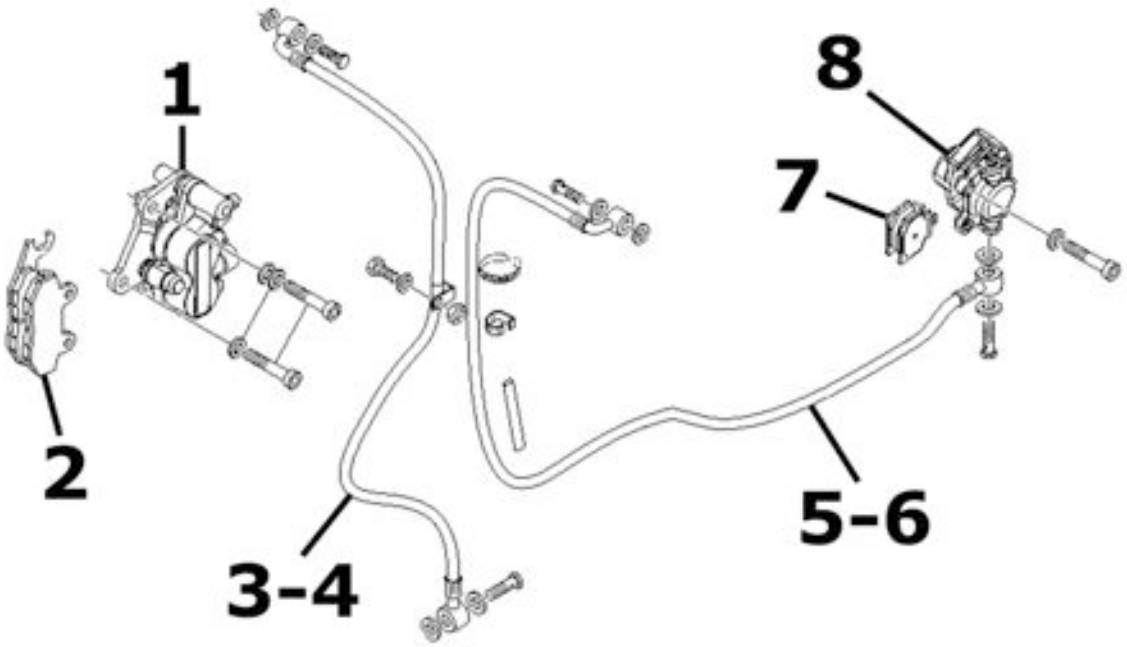
Front suspension



FRONT SUSPENSION

	Code	Action	Duration
1	003011	Front shock absorber - Removal and refitting	
2	003045	Steering column - Replacement	
3	003010	Front suspension - service	
4	003035	Shock abs. and brake caliper support - Replacement	
5	003034	Front wheel hub bearings - Replacement	
6	001064	Speedometer gear - Replacement	

Braking system

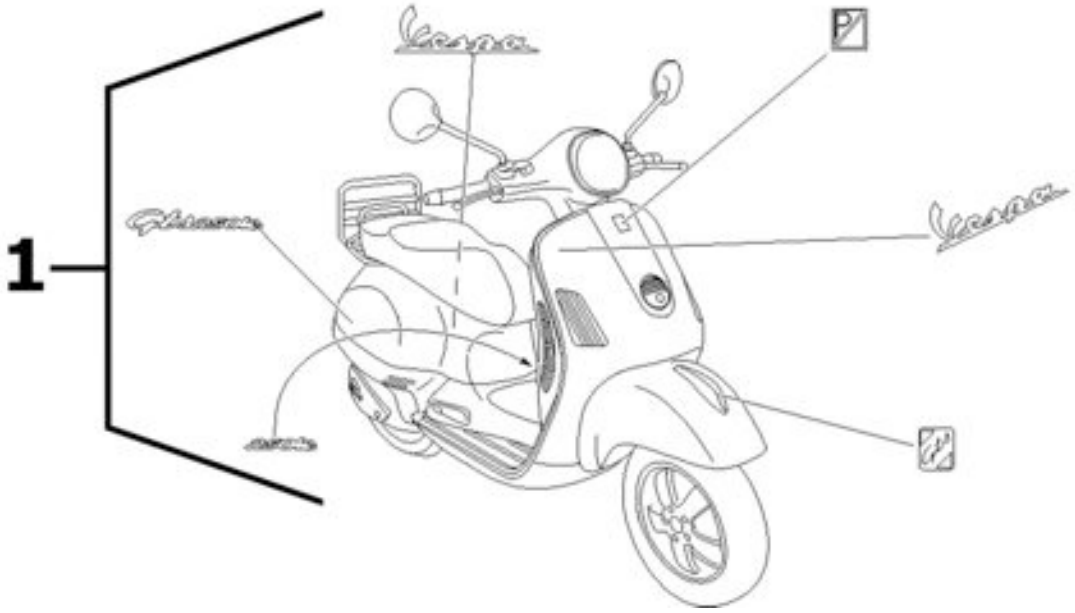


BRAKE SYSTEM

	Code	Action	Duration
1	002039	Front brake calliper - change	
2	002007	Front brake pads - change	
3	002021	Front brake hose - change	
4	002047	Integral brake fluid and system bleeder - change	
5	002020	Rear brake hose - change	
6	002080	Rear brake oil bleeding system - change	

	Code	Action	Duration
7	002002	Rear brake pads - change	
8	002048	Rear brake calliper - change	

Stickers



STICKERS

	Code	Action	Duration
1	004159	Plates / Stickers - change	